Report on the Environmental and Land Use Impacts of Renewable Electric Generation in Vermont

In response to Act 56 of 2015

Vermont Agency of Natural Resources, in consultation with

Department of Public Service and Agency of Agriculture, Food and Markets

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1. INTRODUCTION

In 2015 the Vermont General Assembly enacted Act 56 (H.40), which among other provisions established the first renewable energy standard (RES) for Vermont. In acknowledgement of the recent expansion of renewable energy generation in the state and the Act's requirements for additional generation through the RES, Act 56 instructed the Secretary of Natural Resources to report on the environmental and land use impacts of renewable electric generation in Vermont:

On or before December 15, 2015, the Secretary of Natural Resources, in consultation with the Secretary of Agriculture and the Commissioner of Public Service, shall report to the House and Senate Committees on Natural Resources and Energy on the environmental and land use impacts of renewable electric generation in Vermont, methods for mitigating those impacts, and recommendations for appropriate siting and design of renewable electric generation facilities. The report shall include examination of the effects of renewable generation with respect to water quality, wildlife habitat, fragmentation of forest land, agricultural soils, aesthetics, and any other environmental or land use issue the Secretary considers relevant. ***2015 Act 56 - Sec. 21c. RENEWABLE GENERATION; IMPACTS; REPORT (pg. 53-54)***

The Agency of Natural Resources (Agency) is confident that Vermont's in-state renewable generation goals can be achieved while minimizing significant environmental and land use impacts, provided new generation is well planned and well sited. Well sited renewable generation that displaces fossil fuel use is a critical climate change mitigation strategy. Responding to climate change is a top priority for the Agency, so we welcome the opportunity to share recommendations, along with the Department of Public Service and the Agency of Agriculture, for how to mitigate impacts and improve the siting and design of renewable electric generation facilities in the future.

2. STATUTORY AND POLICY FRAMEWORK

In 2014, roughly 60% of Vermont's electricity was supplied from renewable sources. About thirty percent came from Hydro-Quebec and the remaining 30% from in-state solar, wind, hydro, methane and wood generators. When adjusted for the sale of Renewable Energy Credits (REC) by in-state generators, Vermont's 2014 electric portfolio drops from 60% to 45% renewable, as most of the RECs generated in-state are currently sold through regional markets to utilities in states with pre-existing renewable portfolio standards.

Beginning in 2017, Vermont's new RES will require distribution utilities' REC-adjusted electric supply to be 55% renewable in 2017, rising 4% every three years, to 75% in 2032, inclusive of out of state supply such as power from Hydro-Quebec. The RES also establishes standards for increased distributed renewable generation, requiring 1% from new distributed generators that support Vermont's electric grid and that are generally no greater than 5MW in capacity in 2017, rising 0.6% per year, to 10% in 2032. To satisfy these requirements, RECs from these distributed generators – which are highly likely to be located in state – will need to be retired in Vermont. The requirement to grow distributed generation from 1% to 10% in 2032 will drive the deployment of new, in-state renewable plants for the next 15 years.

Beyond 2032, the state's energy future is guided by several statutory and policy goals. The 2016 Comprehensive Energy Plan, developed under the framework of 30 V.S.A. § 202(b), establishes the goal

of meeting 90% of the state's total energy needs with renewable energy by 2050. The state's statutory and policy goals for reducing greenhouse gas emissions have informed the selection of these goals for growth of renewable energy in Vermont.

Existing statute (10 V.S.A. § 578(a)) sets the goal of reducing the emissions of greenhouse gases from within the geographical boundaries of the state and those emissions from outside the boundaries of the state that are caused by the use of energy in Vermont in order to reduce emissions of greenhouse gases from the 1990 baseline by 50% by 2028 and, if practicable using reasonable efforts, 75% by 2050.

Recently, informed by results from the Public Service Departments Total Energy Study (TES) (http://publicservice.vermont.gov/publications/total_energy_study), Vermont added a new goal to the 2016 Comprehensive Energy Plan (CEP) (http://publicservice.vermont.gov/publications/energy_plan): a 40% reduction from 1990 levels by 2030. The modelling conducted during the study suggests that this goal is achievable if the state pursues certain technology and policy pathways for reducing state-wide energy use and increasing the share of energy from renewable sources. In 2015, Vermont also joined its neighboring New England states and the eastern Canadian provinces in setting a regional emissions reduction goal of 35 to 45% below 1990 levels by 2030.

3. CURRENT AND FUTURE CONDITIONS

The Total Energy Study (TES) and 2016 Comprehensive Energy Plan (CEP) provide a detailed overview of Vermont's energy policy and legislative goals. They also provide a comprehensive look at the existing state of energy generation in Vermont. This baseline is important when considering the environmental and land use impacts of future renewable generation.

For instance, the draft CEP states that there are approximately 120 MW of solar PV deployed (of which about 30 MW are residential rooftop-scale systems under 10 kW), and there are more than an additional 80 MW announced or in some stage of the permitting process. Assuming one MW of solar requires roughly 7 acres of land, current or announced ground-mounted solar generation represents roughly 1000 acres in Vermont. The CEP sets forth several scenarios of energy mix necessary to reach the 90% renewable energy goal; those scenarios call for an additional 8,000 to 13,000 acres of in-state solar generation by 2050, some of which could be built on commercial rooftops, over large parking lots and on already disturbed lands such as landfills and brownfields.

The TES also envisions an increase in utility scale wind generation. Currently 52 large turbines are in operation in Vermont; to reach the 90% by 2050 goal, the TES suggests an additional 36 to 106 new turbines would need to be constructed in Vermont, depending on future energy mix and increases in turbine efficiency. Approximately 37 new utility-scale turbines, in three separate projects (Swanton, Irasburg, Windham/Grafton), are currently in some stage of exploration/pre-development in Vermont.

4. RECENT RENEWABLE GENERATION PUBLIC PROCESS

As the number of renewable generation projects deployed in Vermont has increased over the past five years, a number of conversations have occurred intended, in part, to provide guidance and recommendations for the energy siting process and minimize impacts on the environment and land use.

Those include:

- Governor's Energy Generation Siting Policy Commission (http://sitingcommission.vermont.gov/)
- Public Service Board Act 99 Net Metering workshop (http://psb.vermont.gov/statutesrulesandguidelines/proposedrules/rule5100)
- Public Service Department/Regional Planning Commission Energy Planning Pilot (http://solartaskforce.vermont.gov/sites/solarsiting/files/documents/meeting_materials/BCRCEnergyPresentationNovember2015.pdf)
- Public Service Department Hydropower study ((http://publicservice.vermont.gov/sites/psd/files/Pubs_Plans_Reports/Legislative_Reports/Act%20165%20Legislative%20Report_withappendices_011514.pdf)
- Solar Siting Task Force (http://solartaskforce.vermont.gov/)

5. ENVIRONMENTAL AND LAND USE IMPACTS

Most forms of development have an impact on Vermont's environment and land use patterns. Residential, commercial and industrial structures, transportation infrastructure and non-renewable energy production all have the potential to impact water quality, wildlife habitat, forest lands, air quality, agricultural soil and the state's aesthetic values – so is the case with most forms of renewable energy generation. So as with all development, careful site selection and design of renewable generators will greatly minimize negative impacts on land use and the environment.

While the potential for impacts are similar, one way renewable generation differs from these more tradition forms of development is in location and pattern. Wind and solar generators, especially, have been built in locations that would be unlikely sites for homes or businesses: high elevation ridgelines, floodplains and low lying meadows dominated by wetlands. The pattern of renewable generation deployment is also unique. Distributed by nature, generators typically do not follow traditional land use and development patterns and were only recently made to comply with setbacks typical for other structures. These differences have required new thinking about how best to locate and design renewable generators to minimize their impact on the natural environment.

The following section provides an overview of the range of impacts and recommends measures to mitigate impacts through improved siting and design. It is important to note that while the report generally focuses on impacts associated with the electric generator, similar impacts may be associated with electric transmission line extensions or upgrades that may be necessitated by certain new generators. The section is not exhaustive, but focuses on the most common potential impacts associated with renewable generation.

5.1 WATER QUALITY

Renewable generation has the potential to impact the state's water quality in a number of ways, included, but not limited, to impacts to wetlands that help filter and store water during storm events, impacts to the floodways and river corridors that buffer communities from the inundation and erosion effects of flooding, and from stormwater discharges that may transport sediment and other pollutants into surface waters. These impacts are not unique to renewable generation and could be caused by most forms of development.

5.1.1 Wetlands - Wetlands are commonly known as bogs, fens, marshes, wet meadows, shrub swamps, vernal pools and wooded swamps. Wetlands often occur in association with lakes, ponds, rivers, and streams, creating transitional areas between dry land and open water. Wetlands provide a range of functions and values including water storage, filtration and habitat for wildlife and rare plant species, and are critical for climate adaptation and flood resilience. Wetlands can be difficult to identify, especially in areas of ongoing agriculture, so renewable generation sited in open fields, such as solar, has the potential for widespread impact if facilities are not sited with care. Wetlands in Vermont are protected in statute (http://legislature.vermont.gov/statutes/chapter/10/037) and through the Vermont Wetland Rules (http://www.watershedmanagement.vt.gov/wrprules/wsmd_VWR%207-16-10.pdf). The Department of Environmental Conservation's (DEC) Wetlands Program has regulatory jurisdiction over wetlands which provide significant function or value (Class I and Class II wetlands) plus a fifty foot buffer zone. The Army Corp of Engineers holds jurisdiction over wetlands as well, but not the buffer zone. Impacts to Class I and Class II wetlands, and their associated buffer areas, require a permit from the state Wetlands Program.

Solar: Many solar facilities larger than 50kW in Vermont are located in former agricultural fields. Often farmland owners prefer to install solar in wet hayfields or pasture land that have limited value from an agricultural production perspective rather than more productive upland fields; these wet meadows often include areas of Class II wetland or wetland buffer. While agriculture activity is exempt from state wetlands rules, energy generation facilities in these same locations are not. Because of the interest in siting solar generation in less productive, often wet farmland, minimizing wetland impacts has been a major focus of the Agency's regulatory review work.

Since 2013 the State Wetland Program has issued 35 wetland permits to allow wetland impacts associated with solar projects, and has conducted close to 400 site visits to potential solar sites necessary to confirm the boundaries of wetland resources and ensure generation facilities are sited to prevent undue adverse impacts to the wetland. Over the past three years the solar development community has largely modified their project development process to include early screening for wetlands and engagement with DEC wetland staff, which has resulted in a relative decrease in permitted wetland impacts – a shift the Agency welcomes and appreciates.

Environmental and land use impacts:

- Impacts from construction activity, access roads, equipment pads, array posts or racking, and underground conduits.
- Impacts to forested or shrubby wetlands resulting from one-time or ongoing clearing or vegetation management necessary to clear a site for construction or, more commonly, prune or remove trees that may cast shade on the solar array in the future, reducing the energy output.
- Ongoing impacts of maintaining hayfield condition of wetlands or buffer previously used in agriculture. Typically wetlands which are no longer in agricultural use develop into shrub swamps or forested swamps over time which provide more function and value than in a hayfield state.
- For facilities sited near wetlands, impacts associated with decommissioning the site are likely unless steps are taken to identify and avoid wetlands features in the future.

Wind: Utility Scale wind facilities are typically sited on large tracts of land that may afford some ability to design access roads, turbine pads and distribution lines to avoid impacts to wetland resources; however certain sites with abundant wetlands may make avoidance difficult. Good site selection and project design is critical when proposing wind generation that avoids and minimizes impacts to wetlands.

Environmental and Land Use Impacts:

- Direct impacts from site preparation/clearing, construction activity, access roads, turbine pads, cut/fill areas, electric distribution lines and other project infrastructure.
- Ongoing vegetation management and clearing under distribution lines and along roadways in wetland or wetland buffers.

Electric-led Forest Biomass: Vermont's two electric-led forest biomass generators, BED McNeil and Ryegate, began operating in 1984 and 1992 respectively. More recent proposals for similar facilities were proposed in either open field or existing commercial areas. Such facilities have a large footprint that includes both the plant and fuel storage areas, and may involve new roads and distribution lines – the construction of which have the potential to impact wetlands. The harvesting of wood fuel for generators may also impact wetland areas if generators do not take into consideration the presence of significant wetlands when developing harvest plans.

Environmental and Land Use Impacts

- Direct impacts from site preparation/clearing, construction activity, access roads, facility and fuels storage area, electric distribution lines and other project infrastructure.
- Direct impacts from fuel harvesting activity.

Anaerobic Bio Digesters: Anaerobic digesters are typically located on working farms in close proximity to other farm structures or in already disturbed areas. Digesters have a discrete footprint and can often be sited to avoid impacts to wetlands.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction of digester facility, manure storage structures, roads and distribution lines.

Methods for mitigating impacts

- The Vermont Wetland Rules require a specific sequencing of mitigation methods where the first method must be carried out as much as practicable before moving to the next method. This sequencing is: avoidance, minimization, restoration, and compensation. Avoidance of impacts is the best means to protect wetland resources. In certain cases where wetland impacts cannot be avoided, impacts are minimized and the wetland is restored to providing the same level of function or value to meet Vermont Wetland Rule permit requirements. It is very rare that adverse impacts are justifiable after completing the first three steps (avoid, minimize, restore), but in those cases mitigation payments intended to conserve wetland resources elsewhere in the state are required. With good site selection and project design, the majority of wetland impacts can be avoided, minimized and restored.

- Development within a significant wetland or its buffer zone is prohibited unless it is first authorized by a permit issued by the DEC. Projects should be sited and designed in a manner that avoids impacts to significant wetlands and their buffers. Significant wetlands are designated as Class I and Class II wetlands (including vernal pools).

Recommendations for appropriate siting and design

- Many significant wetlands and hydric soils (a wetland indicator) are mapped on ANR's Natural Resource Atlas. However, not all significant wetlands have been mapped or appear on the Atlas, and not all wetlands are easily recognizable throughout the year. Developers should consult the ANR Atlas as an initial site screening measure.
- If an initial screen indicates any potential for wetlands, it is imperative that a qualified wetland scientist review prospective sites during the appropriate growing season to delineate wetlands and wetland buffers. The Agency's District Wetland Ecologists can and should be contacted early in the site selection and design process for input on avoidance and minimization of wetland impacts. All Class II wetlands receive a 50ft regulated buffer.
- Vernal Pools are considered Class II wetlands. Potential pools should be reviewed during the breeding season (late April-early June) to determine if they are supporting vernal pool species; vernal pools often require a 100' buffer depending on the habitat functions and the species the pool supports.
- If impacts cannot be avoided and a permit is required, Wetland permit processing time may take up to six months, so developers interested in expedited project development should avoid sites that involve significant wetlands or buffers**.** Developers are reminded that they may begin the state wetlands permitting process prior to filing a petition with the PSB.
- If possible, avoid proposing a facility directly up against a delineated wetland buffer boundary. By proposing project infrastructure directly adjacent to edge of a buffer, there is a high potential for inadvertent buffer impacts from equipment and construction related activity. If the site provides the room to keep the project away from the delineated buffer, doing so will accelerate the wetlands review process and help to avoid wetland violations in the future.
- Identify the projects' full limits of disturbance (LOD) in the application, including areas that may require vegetation or shade management in the future. Many group net metered solar applications do not provide accurate depiction of the LOD, and focus simply on what is 'within the fence' of the project; it is critical that all anticipated project impacts – including future tree trimming or clearing- is indicated in the application.
- For wood-fueled generators, comply with harvesting standards that promote forest health and sustainability no less protective than the harvest and procurement standards developed by ANR for the proposed North Springfield Sustainable Energy Project PSB Docket #7833 (Appendix A).

5.1.2 Flood Hazard Areas and River Corridors – Development of the land adjacent to rivers and streams can have a profound effect on the quality of those waterways. Like other forms of development, new construction of renewable generation in flood hazard areas or river corridors can restrict a river's access to its floodplain or constrict the river's ability to meander and achieve equilibrium flows – increasing flood velocities and the erosion hazard risk downstream. Renewable generators are subject to the State Flood Hazard and River Corridor Rule (http://watershedmanagement.vt.gov/rivers/docs/FHA&RC_Rule_Adopted_10.24.2014.pdf) and

facilities located in flood hazard areas or river corridors require a permit from DEC to ensure that there will not be an adverse impact. Limiting encroachments in flood hazard areas and river corridors is critical to protect natural and beneficial floodplain functions that are vital components of the state's flood resilience.

Solar/Wind/ Electric-led Biomass/ Anaerobic Bio Digesters:

Environmental and Land Use Impacts

- New construction in flood hazard areas can raise grades and remove flood storage capacity, leading to higher levels of inundation flooding up and down stream and increase flood risk to public and private investments.
- New encroachments in river corridors may lead to future channel management necessary to protect the encroaching structure as the river meanders in the future. This channel management may prevent the river from achieving its least erosive condition and may accelerate flood velocities and result in increased erosion and flood risk to property and infrastructure downstream.

Methods for mitigating impacts

- Siting facilities outside of flood hazard areas and river corridors is the best strategy to mitigate impacts to water quality.
- Energy facility development within a flood hazard area or river corridor is prohibited unless it is first authorized by a permit issued by DEC.

Recommendations for appropriate siting and design

- Facilities must not represent new encroachments in a river corridor (fluvial erosion hazard area).
- Facilities must be located outside of the inundation floodway.
- River corridors and flood hazard areas are mapped on the ANR Natural Resource Atlas, which should be consulted early in the site selection process.
- Projects proposed for sites within the inundation flood fringe must adhere to the Agency's design and management conditions, and must demonstrate that the soil is suitable to support the infrastructure during an inundation event. It is preferable for transformers, converters and related infrastructure to be located outside of the inundation flood fringe.
- Solar arrays may be located within the inundation flood fringe area provided they are designed and constructed in accordance with the following BMPs:
    - Elevated such that the lowest point of the panel arrays are one foot above the base flood elevation (BFE);
    - Designed and adequately anchored to prevent flotation, collapse, or lateral movement of the structure during the occurrence of the base flood;
    - Constructed with materials resistant to flood damage;
    - Constructed by methods and practices that minimize flood damage; and
    - Constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed or located so as to prevent water from entering or accumulating within the design components during conditions of flooding.

- If an applicant chooses to pursue a site located within the inundation flood fringe, the burden is on the applicant to demonstrate the following through competent testimony in its petition for a Certificate of Public Good and application for a State Flood Hazard Area & River Corridor permit:
    - The elevation of the entire project site,
    - The base flood elevation for the project area,
    - The project's compliance with flood-proofing BMPs, and,
    - The presence of soils suitable to support and anchor the infrastructure during an inundation event and withstand base flood velocities.
    - That in the event of a base flood, the siting of the ground-mounted solar arrays would not significantly decrease flood fringe storage capacity. Alternatively, if the arrays would displace floodwater storage in the flood fringe, the applicant must provide compensatory storage to offset the impacts of the proposal. Volumetric analyses and supporting data must be provided by the applicant and certified by a registered professional engineer.
        - In these instances, the Agency may determine that a proposed project either:
            - Has the potential to materially impact adjacent landowners, in which case the Agency may require an hydraulic analysis to verify that the proposal will not increase flood elevations or velocities for adjacent land owners; or
            - That the proposed project may have no more than a minimal effect on floodwater storage and will not divert floodwaters onto an adjacent property, and thereby waive the requirement for the proposal to provide a compensatory storage offset.

5.1.3 Stormwater – Impervious surfaces, those through which water cannot easily penetrate, have the potential to collect and direct rain water into streams and rivers, transporting sediment and other pollutants that impact water quality. Most renewable generation facilities involve the creation of some new impervious surface. A range of management practices and engineered treatment systems may be deployed at any given site to prevent stormwater from impervious surfaces from discharging into streams and rivers, thereby avoiding or greatly minimizing impacts to water quality. Stormwater discharges of soil and sediment can also result from large areas of open ground, a condition sometimes present during the construction of new facilities; a range of practices and systems also exist to manage construction phase Stormwater impacts.

Stormwater is regulated by DEC; a state operational stormwater permit (http://www.anr.state.vt.us/dec/waterq/stormwater/htm/sw_3-9015.htm) is required for any development that results in an acre or more of impervious surface and a construction stormwater permit (http://www.anr.state.vt.us/dec/waterq/stormwater/htm/sw_cgp.htm) is required for projects that involve an acre or more of earth disturbance during construction. All projects must follow a set of best practices to minimize stormwater discharges during construction.

Solar: If well sited and designed, solar generators can be constructed with a relatively low risk of stormwater impacts. Facilities at sites that require limited earth disturbance and that are installed using driven posts for racking (versus concrete footings or ballasts), typically have relatively small amounts of new impervious surface or open earth during construction. Solar panels themselves are not considered impervious, only the actual footprint of the post or footing that support the arrays, access drives, equipment pads and other hardened surfaces are included in the impervious calculation.

Environmental and Land Use Impacts

- Unmanaged stormwater discharges have the potential to transport sediment and pollutants into surface waters.

Wind: Utility scale wind generators typically require extensive road construction and site preparation that trigger coverage under both a construction and operational stormwater permit. The robust crane paths and wide-radius turns necessary to access ridgeline or high elevation turbine sites create significant impervious surface; as do the large turbine pads and laydown areas typical for wind generators. For instance, Kingdom Community Wind – a 21 turbine facility – involved 27.46 acres of new imperious surface; Iberdrola's Sheffield project – a 16 turbine facility – involved 20.75 acres of new impervious.

Environmental and Land Use Impacts

- Unmanaged stormwater discharges have the potential to transport sediment and pollutants into surface waters.

Electric-led Forest Biomass/ Anaerobic Bio Digesters: Biomass plants and digesters are more similar to traditional commercial or industrial development than other distributed generators and therefore can likely pursue conventional approaches to stormwater management. In addition to construction and operational stormwater permit coverage, certain biomass or digester facilities may require coverage under a multi-sector stormwater permit (http://www.anr.state.vt.us/dec/waterq/stormwater/htm/sw_msgp.htm).

Environmental and Land Use Impacts

- Unmanaged stormwater discharges have the potential to transport sediment and pollutants into surface waters.

Methods for mitigating impacts

- Minimize earth disturbance during construction and the creation of new impervious surfaces or obtain coverage under a state stormwater permit.

Recommendations for appropriate siting and design

- Sites that require less grading or earth disturbance (clearing, stumping and grubbing of trees) may stay under threshold that requires a stormwater construction permit, thereby minimizing stormwater impacts.
- Sites that do not require long access drives, concrete footings and other impervious surfaces may stay under threshold that requires a stormwater operational permit, thereby minimizing stormwater impacts.

- At a minimum, generation projects should be constructed in accordance with the Low Risk Handbook for Erosion Prevention and Sediment Control (2006) (http://www.anr.state.vt.us/dec/waterq/stormwater/docs/construction/sw_low_risk_site_handbook.pdf).
- For projects that involve extensive road infrastructure and cut/fill slopes, such as ridgeline wind, design projects so that roads and crane paths can be narrowed and seeded down with vegetation once construction is complete and develop plans to re- vegetate non-vertical cut/fill slopes.
- Pre-construction baseline modelling for geomorphic, chemical and biotic stream condition for large projects, such as utility scale wind project, is recommended. Establishing a baseline for stream conditions will inform future monitoring and help to determine what, if any, water quality impacts may have resulted from the project.

Certain renewable generation technologies have the potential to improve water quality. Anaerobic bio digesters fueled primarily by cow manure is one. Cow manure is high in phosphorous; phosphorous is a pollutant and phosphorous levels in Lake Champlain and several other large Vermont lakes exceed targeted levels; so the opportunity to remove phosphorus from manure before it is applied on fields and able to wash into streams and rivers would be beneficial from a water quality perspective. Green Mountain Power plans to construct and operate at least one anaerobic digester in the Lake Champlain basin and is currently exploring the feasibility of phosphorous removal as part of that project. Deployment of manure digesters capable of removing phosphorous from polluted watersheds have the potential to improve water quality.

Another opportunity is with solar facilities located on parking lots and other impervious areas that currently lack stormwater treatment. Older parking areas that were constructed prior to current stormwater regulations may discharge pollutants into surface waters during storm events. Deploying solar in these areas would likely require some upgrades in stormwater management that could help improve water quality.

5.1.4 Hydropower – New, in-state hydroelectric generation will require a license (or exemption from license) from the Federal Energy Regulatory Commission (FERC) (http://www.ferc.gov/). Pursuant to Section 401 of the Federal Clean Water Act any new hydroelectric generators will require a Water Quality Certification from the Vermont Department of Environmental Conservation.

Environmental and Land Use Impacts

- Impacts to streamflow and aquatic habitat from flow and water level manipulation associated with hydropower operations.
- Impacts on the movement of fish and other aquatic life, interruption of natural river processes, and loss of riverine habitat due to the construction of dams or diversion structures.
- Impacts to existing aquatic habitat and riparian habitat due to construction related activities. Effects on chemical water quality parameters (temperature and dissolved oxygen) and aesthetics due to hydropower operations.

The water quality, wildlife and aquatic habitat and forest land fragmentation impacts associated with new hydroelectric generators are addressed through the FERC licensing and 401 certification process. Hydropower development in Vermont has a long history, as Vermont relied on hydropower almost exclusively for power prior to the 1920s. As a result, the best sites have been developed, limiting the potential for new, utility scale hydropower generation in Vermont. The potential for the development of smaller, net metered type hydropower facilities does exist and the environmental and land use impacts associated with facilities are also addressed through the FERC licensing and 401 certification process.

Recommendations for appropriate siting and design

- Site projects at existing dam or natural water feature to reduce the impact of new instream obstructions that prevent the movement of fish and other aquatic life, and other associated impacts on wetlands, natural river processes, and water quality.
- Operate projects in true run-of-river[1] mode where there is virtually no bypass (tailrace discharges at the dam or into plunge pool close to the dam such that adequate circulation is maintained)

5.2 WILDIFE HABITAT

Vermont is largely a rural state with extensive habitat for a wide range of plant and animal species. The Agency typically focuses its regulatory review and protections on a narrowed set of habitat types – those that are critical or unique, such as necessary wildlife habitat and significant natural communities, as well as habitat types that support rare, threatened or endangered species.

5.2.1 Necessary Wildlife Habitat, Significant Natural Communities, and other Wildlife-related Impacts

– There are many types of wildlife habitat in Vermont that the Vermont Fish and Wildlife Department considers "necessary" and essential to the survival of a wide array of fish and wildlife. Some of these include a variety of wetland conditions that provide critical functions to wetland-dependent wildlife, riparian habitats along streams, rivers, lakes and ponds that provide travel corridors for many species of wildlife, refugia for water-oriented wildlife, and habitat for aquatic organisms, deer winter habitat, black bear feeding habitat, wildlife travel corridors at a variety of scales (e.g., for migrating amphibians to ranging black bears), moose winter habitat, high elevation nesting songbird habitat, grassland bird nesting habitat, heron rookeries, among others.

ANR seeks to ensure the long-term integrity of these essential wildlife habitats by avoiding their loss and degradation. Some of the more common necessary wildlife habitats encountered when siting renewable generators are deer wintering areas, mast concentration areas used by black bear and other wildlife, certain grasslands that support grassland nesting birds, wetlands with significant wildlife functions, riparian areas, wildlife travel corridors, bat habitat, vernal pools and upland habitat for pool-breeding amphibians.

[1] A true run-of-river project is one which does not operate out of storage and, therefore, does not artificially regulate streamflows below the project's tailrace. Outflow from the project is equal to inflow to the project's impoundment on an instantaneous basis.

Natural communities are assemblages of plants, animals, soils and the ecological processes that support them (e.g., rich northern hardwood forest, floodplain forest, rich fen, black spruce bog). Significant natural communities are those that are of high ecological value based on their condition, size and rarity. In most instances, ANR protects what are referred to as "rare and irreplaceable natural areas" which are typically defined as assemblages of significant natural communities. For instance, with wind energy projects sited along high ridgelines, it's not uncommon to encounter multiple rare, unique and high quality natural communities supporting rare plant and animals. ANR focuses on ensuring the long-term integrity of these RINAs through the Public Service Board review process.

Solar: Because solar generators are most often located in open fields, they have the potential to impact habitat for grassland nesting birds and some wetland-related habitat. Increasingly, solar projects are being proposed in wholly forested areas or at sites that require substantial clearing or shade management. These forested areas may provide deer wintering habitat or necessary habitat for other wildlife, including riparian areas that provide and enhance habitat for terrestrial and aquatic species. The location of the facility as well as any associated fencing are important when considering impacts to necessary wildlife habitat and whether the facility will prevent wildlife from accessing habitat they rely on for food or shelter.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may destroy or imperil necessary wildlife habitat.
- Indirect impact from the construction or operation of a renewable generator may compromise, destroy or imperil necessary wildlife habitat and displace sensitive wildlife from otherwise suitable habitat.
- The cumulative direct or indirect impact of multiple generators on certain necessary wildlife habitat within a discrete geographic area or region may destroy or imperil habitat functions and values adversely, in a way that a single project alone may not.

Wind: Utility scale wind projects are typically constructed over large, often linear areas and constitute landscape scale features that have the potential for significant direct and indirect impacts on necessary wildlife habitat and significant natural communities, both from the construction and operation of the facility. The high elevation, remote nature of typical wind sites are also more likely to support interior forest habitat and other necessary wildlife habitat, unique species of plants and animals and uncommon natural communities.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may destroy or imperil necessary wildlife habitat and compromise significant natural communities.
- Mortality impacts to migrating birds and bats resulting from collisions with turbines (these events typically occur during periods of spring and fall migration and the degree of effect varies by species, but is of particular concern for various species of bats, many of whose populations have experienced catastrophic declines in recent years).
- Introduction of invasive species into remote mountain settings.

- Indirect impact from the construction or operation of a renewable generator may compromise, destroy or imperil necessary wildlife habitat and displace sensitive wildlife from otherwise suitable habitat.
- The cumulative direct or indirect impact of multiple generators on certain necessary wildlife habitat within a discrete geographic area or region may destroy or imperil habitat functions and values adversely, in a way that a single project alone may not. This is of particular importance given the large areas required for wind energy projects and the remote, high elevation environments where they occur.

Electric-led Forest Biomass: These facilities are typically located in open fields or existing industrial areas that do not support significant wildlife habitat or natural community values; however, potential sites must be screened for wildlife habitat and designed to avoid impacts. The harvesting of wood to fuel the facility can pose real impacts to wildlife habitat and significant natural communities if harvests are not well planned and designed to identify and avoid such impacts. The Department of Fish and Wildlife currently reviews timber harvest plans for the state's two existing wood powered electric-led biomass plants to ensure harvests do not adversely impact certain wildlife habitat, including deer winter habitat, wetlands and habitat for threatened and endangered species.

Facilities developed for the primary purpose of generating electricity with wood fuel are not an efficient use of Vermont's forests. Modern electric-led generators have an efficiency rate of roughly 25%. Thermal energy applications of wood fuel reach far higher efficiencies and should be prioritized over electric-led facilities.

When the proposed North Springfield electric-led biomass facility was reviewed by the Public Service Board in 2013, the Agency proposed an updated harvest standard necessary to promote forest health and sustainability and provide adequate protections for wildlife habitat and significant natural communities (Appendix A). This standard should be the minimum for any new electric-led wood fueled biomass facility proposed in Vermont in the future.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may destroy or imperil necessary wildlife habitat and significant natural communities.
- Indirect impact from the construction or operation of a renewable generator may compromise, destroy or imperil necessary wildlife habitat.
- The cumulative direct or indirect impact from the harvesting of wood fuel on certain necessary wildlife habitat within a discrete geographic area or region may destroy or imperil habitat functions and values adversely.

Anaerobic Bio Digesters: Anaerobic digesters are typically located on working farms in close proximity to other farm structures or in already disturbed areas that do not support significant wildlife habitat or natural community values. Digesters have a discrete footprint and can often be sited to avoid impacts; however, potential sites must be screened for wildlife habitat and designed to avoid impacts.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may destroy or imperil necessary wildlife habitat.

- Indirect impact from the construction or operation of the facility may compromise, destroy or imperil necessary wildlife habitat.

Methods for mitigating impacts

- Avoidance of direct and indirect impacts is the best means to protect necessary wildlife habitat. If impacts cannot be avoided, all practicable efforts should be made to minimize impacts through the location, design and operation of the facility. (Keep in mind that these impacts are complex and involve a great many species of plants and animals. As such, understanding how to assess impacts and how to best avoid, minimize and otherwise address them is equally complex. The issues range from considering the physical loss of a specific habitat such as softwood cover that comprises part of a deer winter habitat, to the loss of high elevation softwood cover that comprises nesting habitat for the rare and declining Bicknell's thrush, to the fragmentation of large blocks of remote, undeveloped habitat, to the intricacies of migration for hundreds of species of birds and numerous species of bats and how and why they collide with turbines.)
- In unique cases where impacts cannot practicably be avoided or minimized, mitigation – such as the conservation of additional habitat - may be necessary to offset project impacts. . In some cases, the Agency may take the position that a site is unsuitable for a project and encourage alternative sites be considered.

Recommendations for appropriate siting and design

- Deer Wintering Areas (DWA):
  - Projects proposed in the vicinity of DWA must adhere to the Department of Fish and Wildlife's *Guidelines for the Review and Mitigation of Impacts to White-Tailed Deer Winter Habitat:* http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Guidelines_for_the_Review_and_Mitigation_of%20Impacts_to_White-Tailed_Deer_Winter_Habitat.pdf
  - Projects should avoid direct impacts to DWA including, but are not limited to:
    - Clearing, topping and thinning of vegetation for shade management within an identified DWA.
    - Construction, maintenance or decommission activities within an identified DWA during the wintering period, typically December 15 through April 15.
  - Projects should also avoid indirect impacts within 300' of a DWA*, which is considered the buffer area. Potential project-related impacts to the buffer include, but are not limited to:
    - Clearing, topping and thinning of vegetation within an identified DWA buffer area.
    - Construction, maintenance or decommission activities during the wintering period, typically December 15 through April 15.
    - The installation and operation of energy generators, fencing, roads, transmission infrastructure or any project component within the buffer area.

    * For solar projects that involve relatively limited noise and human activity once constructed, a buffer of 50'-100' from a DWA may be sufficient to mitigate secondary impacts.
- Wildlife Passage and Fencing: Fencing can impact wildlife mobility in and around the facility site so avoiding or limiting the use of fencing is recommended. When fencing is required fencing

should be proposed that is permeable to most wildlife (e.g. woven wire fence with opening dimensions of 4" x 6").

- Riparian Areas: a minimum 50' undisturbed, vegetated buffer should be maintained between the project limits of disturbance and the top of bank of rivers and streams. No clearing or thinning for shade management should occur within the riparian area.
- Sites that provide habitat for grassland nesting birds may require specific management or mitigation considerations; developers should engage Department of Fish and Wildlife staff early in their site selection process to determine if a site raises grassland habitat issues.
- Required wildlife habit and natural community surveys and studies, including wind generator surveys for bird and bat species, should be conducted during appropriate seasons and with the input and engagement of Agency technical staff.
- Construction of new generators should follow best practices for the control and monitoring of invasive species, which – if introduced by the project – can have an adverse impact on necessary wildlife habitat and significant natural communities.
- For wood-fueled generators, comply with harvesting standards that promote forest health and sustainability no less protective than the harvest and procurement standards developed by ANR for the proposed North Springfield Sustainable Energy Project PSB Docket #7833 (Appendix B).

5.2.2 Rare, Threatened and Engaged Species (RTE) Habitat – State law prohibits ***taking*** a ***threatened or endangered species*** without prior authorization from the Secretary of the Agency, which may only be obtained through a formal permitting process and issuance of a takings permit. The Public Service Board has also acknowledged protection of state **rare** species. Taking is broadly defined and includes: 1) pursuing, shooting, hunting, killing, capturing, trapping, snaring and netting fish, birds and quadrupeds *and all lesser acts, such as disturbing, harrying or worrying or wounding*; and 2) with respect to wild plants, *uprooting, transplanting, cutting, injuring or killing*. Applicants for a Takings Permit must demonstrate that reasonable steps have been taken to avoid and minimize takings in their project siting and design.

Solar: Impacts to rare plants and grassland nesting habitat for RTE birds are the most common RTE impacts associated with solar generators. Often impacts to plants can be avoided provided plant surveys are performed prior to the application process and during the appropriate time of year to identify species.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity may take or adversely impact RTE species or habitat.
- Indirect impact from the construction or operation of a renewable generator may take or adversely impact RTE species or habitat.
- The cumulative direct or indirect impact of multiple generators on certain RTE species or their habitat within a discrete geographic area or region may have an adverse impact on the species, in a way that a single project alone may not.

Wind: Due to the significant amount of clearing and high elevation nature of most utility scale wind projects, the potential for RTE impacts is higher than with most renewable generators. Surveys for both RTE plants and animals are necessary in the early stages of planning a wind project and certain surveys

may need to be performed over several seasons and multiple years. In addition to terrestrial RTE species, wind turbines have the potential to impact avian species such as birds and bats. Surveys for bats, breeding birds and migratory birds are all required to establish the type and volume of avian species near proposed sites. Surface water features such as ponds and lakes provide habitat for certain avian RTE species, so the relative location of turbines to surface water features must also be considered when planning a facility. RTE bat activity is limited to nighttime hours, from spring through fall, and only under certain wind conditions – when conditions favorable for RTE bats exist, wind generators will likely need to curtail their operation to avoid impacts to those species.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity may take or adversely impact RTE species or habitat.
- Indirect impact from the construction or operation of a renewable generator may take or adversely impact RTE species or habitat.
- The cumulative direct or indirect impact of multiple generators on certain RTE species or their habitat within a discrete geographic area or region may have an adverse impact on the species, in a way that a single project alone may not.

Electric-led Forest Biomass: These facilities are typically located in open fields or existing industrial areas that do not support significant wildlife habitat or natural community values; however, potential sites must be screened for RTE species and habitat, and designed to avoid impacts. However, the harvesting of wood to fuel the facility may have incidental impacts on RTE species.

As referenced above, the harvesting standards developed by the Agency in 2013 for the North Springfield electric-led biomass facility address RTE species and should serve as the minimum standard for any new electric-led wood fueled biomass facility the proposed in Vermont in the future.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may impact or take RTE species.
- Indirect impact from the construction or operation of the facility may impact or otherwise take RTE species.

Anaerobic Bio Digesters: Anaerobic digesters are typically located on working farms in close proximity to other farm structures or in already disturbed areas that do not support RTE species. Digesters have a discrete footprint and can often be sited to avoid impacts; however, potential sites must be screened for RTE species.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity (including necessary electric distribution line upgrades) may impact or take RTE species.
- Indirect impact from the construction or operation of the facility may impact or otherwise take RTE species.

Methods for mitigating impacts

- Projects should be sited and designed to avoid impacts to rare, threatened or endangered (RTE) plant and animal species. Impacts to threatened or endangered species are prohibited unless an applicant first obtains a takings permit from the Agency.
- Many RTE element occurrences are mapped on the ANR Natural Resources Atlas; however there are likely many more occurrences that have yet to be identified and do not appear on the Atlas. Because of this, applicants are strongly encouraged to engage a qualified consultant to review project plans and available RTE information and conduct a site specific RTE survey if ANR determines it is necessary. The following site characteristics likely will necessitate an RTE plant or animal survey as part of the petition:
    - Proximate to wetlands, rivers, forest canopy gaps.
    - Documented occurrences of RTE plants or animals in the vicinity.

  Other factors that might influence the need for a RTE plant or animal survey include the influence of current vegetation, landscape setting, bedrock, soils, and degree of past disturbance

Recommendations for appropriate siting and design

- Please note that RTE *plant surveys are only appropriately performed during the high summer months, typically late June through mid-Sept*. RTE animal surveys may also be seasonally constrained due to the behavior of the species. Survey design and methods should be developed in close coordination with the Vermont Department of Fish and Wildlife. Surveys performed outside this season will not be accepted as complete, and additional survey work during the appropriate season will be necessary. Applicants are strongly cautioned to keep this seasonal restriction in mind when planning projects.
- State law prohibits ***taking*** a ***threatened or endangered species*** without prior authorization from the Secretary of the Agency, which may only be obtained through a formal permitting process and issuance of a takings permit. Applicants for a Takings Permit must demonstrate that reasonable steps have been taken to avoid and minimize takings in their project siting and design.
- Indiana Bat – The Indiana bat is a federally endangered species. Construction of generators should avoid the clearing of trees greater than 12" DBH in areas of Indiana bat range: sites at elevations below 1000' in the Champlain Valley from Hinesburg to Orwell. If impacts cannot be avoided, an applicant may be required to perform bat habitat assessment, roost tree surveys or acoustic surveys, which are only possibly during the months of June and July. Such assessments will be required if forest clearing must be conducted when bats are active (April-October).
- Northern Long Ear Bat (NLEB) – the NLEB is another federally endangered bat species that has less specific habitat requirements than Indiana Bat and a wider range in Vermont. Developers of new generators should confer with the Vermont Department of Fish and Wildlife on the current recommended practices for avoiding and minimizing impacts to NLEB habitat.
- Wind facilities should implement curtailment plans intended to avoid impacts to avian species, and approved monitoring plans to track any mortality associated with the operation of the facility.
- For wood-fueled generators, comply with harvesting standards that promote forest health and sustainability no less protective than the harvest and procurement standards developed by ANR for the proposed North Springfield Sustainable Energy Project PSB Docket #7833 (Appendix A).

5.3 FRAGMENTATION OF FOREST LAND

Vermont's forests are one of the state's greatest assets, they support our $1.5 billion forest products industry, provide the backdrop to our tourism economy and offer unmatched opportunities for outdoor recreation. Vermont's forests are also critical components of the state's flood and climate resilience, absorbing and slowing flood waters, capturing carbon dioxide and offering animals and plants pathways for migration as the climate changes around them. We are fortunate that the state's forests are expansive, diverse and largely healthy and intact; however, they are increasingly stressed by shifting weather patterns, invasive species and the fragmenting effects of development. Forest values and threats are detailed in the Department of Forests, Parks and Recreation 2015 Vermont Forest Fragmentation Report:

(http://fpr.vermont.gov/sites/fpr/files/About_the_Department/News/Library/FOREST%20FRAGMENTATION_FINAL_rev06-03-15.pdf).

In addition to the direct fragmenting effects on forest land from clearing trees to build renewable generators, forest conversion also creates an initial GHG deficit for renewable plants from the release of standing carbon and reduction in future carbon sequestration potential (discussed in more detail in the Air Quality and Climate section, below). This net GHG analysis should be part of the Public Service Board's review of any generator that proposes to clear significant areas of forest relative to the capacity of the generator. On a related note, Section 9 of Act 56 requires the Commissioner of the Department of Forests, Parks and Recreation to develop 'Biomass Renewability Standards' for wood fuel to qualify as renewable energy under the RES, those standards are due in the summer of 2016.

ANR has developed several useful sets of information to guide our understanding of unfragmented forests in Vermont, including the forest block analysis, the BioFinder analysis, and the Vermont Conservation Design analysis. All of these help identify and prioritize Vermont's forest habitat blocks. This is essential information to guide siting of renewable energy projects in a way to avoid or minimize the effects of fragmentation.

Solar: Widely distributed generators such as solar have the potential for a dispersed, cumulative impact on forest integrity when sites require the clearing of forestland. In the past two years at least three utility-scale solar projects have been proposed for fully forested parcels that require approximately 20 acres of clearing at each site. An increasing number of smaller group-net metered generators have been proposed at forested locations that require upwards of 5 acres of forest clearing, and dozens of solar projects at all scales propose the clearing of trees to manage shade during construction and on an ongoing basis for the life of the facility. Given that the PSD estimates that at most 13,000 additional acres of solar are necessary to meet the state's renewable energy goals, those facilities can and should be located at sites that do not require significant forest clearing and fragmentation.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity related to site clearing or shade management.
- Ongoing impacts from tree pruning and removal associated with shade management.
- Potential impacts to local and regional habitat corridor and connectivity.

- Introduction of invasive plants to interior forest communities.
- Changes to soil and forest hydrology.
- Indirect impacts on wildlife associated with project activities and other human activities created by the presence of roads and infrastructure.
- Initial deficit of GHG emissions from land conversion and loss of future sequestration.

Wind: Landscape scale features such as large, utility-scale wind generators have the potential to fragment forest blocks or important habitat corridors. Large wind projects typically require the clearing of significant forested acreage for turbine pads, lay down areas, roads, buildings and distribution lines. For instance Kingdom Community Wind, a 21-turbine project, involved approximately 130 acres of forest clearing; Georgia Community Wind, a 4-turbine project, involved approximately 36 acres of forest clearing. Ridgeline locations have particularly high potential for impacts; their generally remote location support interior forest conditions, which are the most at risk from fragmentation; the physical characteristics of ridgelines often make them important corridors for the movement of a wide range of species; and thin mountain soils are more susceptible to disturbance and erosion.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity, especially for high value forest habitat blocks.
- Ongoing impacts from the operation of the facility including vehicular traffic, noise and the potential transport of invasive species into the interior of high value forest habitat blocks.
- Potential impacts to local and regional habitat corridors and habitat connectivity.
- Changes to soil and forest hydrology.
- Indirect impacts on wildlife associated with project activities and other human activities created by the presence of roads and infrastructure.
- Initial deficit of GHG emissions from land conversion and loss of future sequestration.

Electric-led Forest Biomass: Electric-led biomass generators consume wood inefficiently and can negatively impact forest health and sustainability if fuel harvesting and procurement do not follow adequate standards. Wool fuel can reach great efficiencies in thermal-led applications and the Agency strongly supports expansion of modern wood heating systems in Vermont; however, wood fuel should be avoided as primary source of electric generation.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity related to site clearing or transmission upgrades.
- Impacts from fuel harvesting operations if harvests are not planned for forest health and sustainability, consistent with appropriate harvesting and procurement standards.

Anaerobic Bio Digesters: Anaerobic digesters are typically located on working farms in close proximity to other farm structures or in already disturbed areas, which do not require the clearing of forest land. Clearing forested sites for digesters should and like can be avoided.

Environmental and Land Use Impacts

- Direct impacts from site preparation and construction activity related to site clearing or transmission upgrades.

Methods for mitigating impacts

- All practicable steps should be taken to avoid siting new generation at forested sites that require tree clearing and forest conversion.
- Where forest fragmentation is the only practicable option, permanently conserve adequate and appropriate lands to mitigate the project impacts on forest integrity and habitat connectivity.
- Manage lands that supply wood fuel for electric generators for forest health and sustainability.

Recommendations for appropriate siting and design

- For wood-fueled electric generators, comply with harvesting standards that promote forest health and sustainability no less protective than the harvest and procurement standards developed by ANR for the proposed North Springfield Sustainable Energy Project PSB Docket #7833 (Appendix A).
- Avoid siting new generation at forested locations where trees are cleared to accommodate the facility.
- Minimize the amount of shade management and ongoing tree clearing or pruning associated with solar generators.
- For large wind projects, site projects to avoid impacting high value forest habitat blocks or important connecting lands; for generation projects of this scale engage with ANR technical staff at the earlies possible juncture to assess the forest values of a potential site and whether the project has the potential for undue adverse effects from fragmentation that cannot be mitigated. This consultation should occur prior to assuming site control or otherwise investing in a particular location.

5.4 AIR QUALITY AND CLIMATE

Renewable energy technologies that do not rely on fuel combustion (e.g., solar, wind) result in zero air emissions at the point of use, and generally have much lower emissions associated with their entire life cycle than do non-renewable alternatives. The combustion of renewable fuels to generate electricity, however, does result in emissions of GHGs and other air pollutants. Emissions from renewable fuel feedstocks and combustion technologies can vary widely, and it is important to promote the use of those renewable fuels and technologies which provide GHG and other air pollutant emissions benefits relative to fossil fuel usage.

5.4.1 – Traditional Pollutants

Anaerobic Bio Digesters: Bio digesters emit air contaminants through the combustion of methane gas in reciprocating engines used to power electric generation equipment. These emissions contain high levels of sulfur dioxide and carbon monoxide, as well as hazardous air contaminants including formaldehyde

and acetaldehyde when compared to a fossil fuel-fired generation facility on a pounds of pollutants per Kilowatt basis. Emissions from bio digesters can be partially mitigated by using generally available types of control technology, and also by treating the biogas before it is combusted.

Electric-led Forest Biomass: A biomass plant the size of McNeil Generating Station emits significant levels of particulate matter and nitrogen oxide pollution as compared to a fossil fuel fired generation facility of similar size. In addition, wood combustion facilities are typically boilers with condensing steam turbines, so overall facility efficiency is lower than, for example, a natural gas cogeneration facility that generates both electricity and thermal energy. It is possible to partially mitigate the emissions of traditional air pollutants from biomass with various types of currently available control technology.

5.4.2 – Greenhouse Gas Emissions

Anaerobic Bio Digesters: Bio digesters enhance the amount of GHGs (methane) produced from a quantity of manure / organic waste. The methane produced often is combusted in a generator to produce electricity. CO_2 is emitted from the combustion, but there is likely an overall GHG benefit due to the destruction of the more potent methane, and avoided GHG emissions from offsetting electricity generated from another potentially higher GHG-emitting source.

Electric-led Forest Biomass: Biomass combustion emits CO_2 at the stack, as well as small amounts of other GHGs like methane (CH_4), and nitrous oxide (N_2O). The more sustainably harvested (i.e., harvested forest plots are well-managed, and allowed to regrow and sequester carbon) the biomass fuel, the lower the lifecycle GHG emissions tend to be. As mentioned above, utility-scale biomass electricity units tend to have relatively low efficiencies, and may not be the best use of a finite biomass resource. "Mitigating" the CO_2 emissions of biomass plants would entail sustainable harvests focused on forest health, and possible use of combined heat and power units instead of those that solely generate electricity, or use of the biomass in other advanced, clean-burning thermal applications that have much higher efficiencies.

Non-Combustion Life Cycle GHG Emissions: Non-combustion renewable electric generators (wind/solar) do not emit greenhouse gases through the direct generation of power, but have components with embodied GHG's and often involve site preparation, construction and transportation activities that emit GHG's. Clearing forested areas for renewable generation also reduces the potential for carbon sequestration in the future. The Department of Forest Parks and Recreation has developed a Forest Carbon Fact Sheet that provides data on stored forests carbon and carbon sequestration rates (Appendix B).

The Public Service Board should require lifecycle GHG analysis of renewable generation projects that propose relatively high levels of forest clearing. The analysis should consider both the carbon impacts resulting from the clearing of current forest cover and lost future sequestration, taking into account the age, type, and density of forest cover, as well as the GHG's embodied in the construction process associated with transportation, site preparation and materials such as concrete; the PSB should use this information to encourage projects, construction techniques and siting that have the lowest GHG to kWh capacity ratios.

REC Disposition: One of the primary environmental and public policy benefits of renewable electric generation in Vermont is the opportunity to reduce GHG emissions associated with the state's retail electric portfolio through the avoidance of fossil fuel alternatives; however, the environmental attributes of renewable generation are severable and robust markets for REC's exist within the New England region. Vermont can only benefit from the GHG reduction benefits of renewable generators if REC's are retained and retired in the state. The majority of renewable generators currently operating or permitted to operate in Vermont sell the REC's associated with their generation to utilities outside the state's boundaries. As demand for appropriate generation sites increase and the environmental and land use impacts of renewable generations expand in a cumulative fashion in Vermont, all efforts should be made to encourage the REC's associated with new generators remain in the state and contribute to Vermont's GHG reduction goals.

5.4.3 – Environmental Permitting and other Air Quality requirements

Both biomass plants and biodigesters would most likely require state permits to construct and operate an air contaminant source. Depending on the size and emission levels of the subject facility, federal Title V operating permits may also be required. Also, each biomass or biodigester facility will need to register their annual emissions with the Air Quality and Climate Division and pay a fee based on the amount of air contaminants emitted.

5.5 AGRICULTURAL SOILS

Solar: The attributes of agricultural soils are attractive to the siting of solar due to several factors: the land is open with no trees and often near transmission lines, the soils are well drained, and agricultural soils can be flat and usually have some form of access from roads to access the crop land. These same attributes are attractive to buildings and other development. The Vermont Agency of Agriculture, Food and Markets (VAAFM) supports solar as a viable renewable energy source, and especially when the installation provides electrical generation that supports the operation of the farm, however, the VAAFM is concerned with the loss of use of primary agricultural soils for agricultural production in Vermont.

The concerns surrounding agricultural soils and solar installations greater than 150kw are as follows:

- The number of acres of ranked and mapped agricultural soil is a limited natural resource in Vermont.
- Soil is not available for full agricultural use during the term of the installation agreement – 20 to 30 years.
- The loss of full use of the agricultural soils can affect water quality through the loading of nutrients on other remaining soils on farms. For farms that have a Large Farm Operations or Medium Farm Operations permit, land available for the spreading of nutrients must be documented and a change in land availability to the farm could result in the farm needing to change the number of livestock that can be supported on the reduced land base.

The VAAFM has requested the following of solar developers on a limited basis through the Section 248 process. (note: the VAAFM is not a statutory party in Section 248 and no specific requirements are in

place for agricultural soils). The Agency has asked solar developers to avoid soils ranked and mapped by USDA NRCS, and as meeting the definition of primary agricultural soils (in 10 V.S.A. 6001 (15)) when siting solar. If these soils cannot be avoided, supports for solar panels should be driven into the ground with an extremely limited use of cement. Other infrastructure of roads, transformers, etc. should be placed to limit excavation of agricultural soils, no excess grading or soil removal should occur and that project siting should not limit or inhibit access to other areas for agricultural use.

Method to mitigate
The VAAFM would propose the following to mitigate the impact of solar on agricultural soils.

- The VAAFM should become a "party by right" in the section 248 process, and be given the right to intervene under Board Rule 2.209(A), *intervention as of right*, and be given "bill back" authority for its involvement in applications.
- The VAAFM would support the dual use of the land under solar arrays for the grazing of livestock as part of an agricultural operation.

Recommendations for Siting and Design

- Solar developers should avoid all USDA ranked soils (agricultural value groups 1 through 8 and soils that are an active part of a farming operation) when siting the solar array.
- Indirect impacts and access to USDA ranked soils should be determined and avoided as part of the siting process.
- The impact of infrastructure should be limited even on unranked soils and limit use of cement/concrete ballasts or wholesale paving of significant farmland.
- Land should not be altered through scraping or grading.
- Explore opportunities to use solar generation as means to transition certain lands out of row crop production in order to contribute to the state's water quality goals.
- At the end of the useful life of the installation all infrastructure should be removed, without reducing the agricultural potential of the ranked soil.

Wind
Land Use/Environmental Impact
At this time, the large scale installation of wind has not adversely affected agricultural soils in Vermont. The installations have been mainly confined to ridgelines that are not ranked as agricultural soils. There are examples across the lake in New York State where large scale wind generation is interspersed with agricultural operations. If this type of wind development were proposed in Vermont, the VAAFM would work to determine the best outcome for the farmers, soils, and wind generation.

Method to mitigate
The VAAFM would request the same of wind developers as with solar.

- The VAAFM should become a "party by right" in the section 248 process and would be granted "bill back" authority for the involvement in applications.
- The VAAFM would support the dual use of the land under wind generation for the cropping and grazing of livestock as part of an agricultural operation.

Recommendation for siting and design

- Wind developers should avoid all USDA ranked soils (agricultural value groups 1 through 8 and soils that are an active part of a farming operation) when siting the wind projects.

- Indirect impacts and access to USDA ranked soils should be determined and avoided as part of the siting process.
- The impact of infrastructure should be limited even on unranked soils and limit use of cement/concrete ballasts or wholesale paving of significant farmland.
- Land should not be altered through scraping or grading.
- At the end of the useful life of the installation all infrastructure should be removed, without reducing the agricultural potential of the ranked soil.

Hydro

Land Use and Environmental Impact

At this time, the majority of impact of hydro is from historical installations of hydro power dams. Many fine agricultural valleys were flooded with the installation of dams in the past. However, the operation of hydro power dams that operate in a store-and release mode with large fluctuations in water level of the impoundment and downstream streamflow has the potential to increase the rate of river bank erosion and the loss of agricultural soils.

If further dams were proposed on Vermont waterways, the VAAFM would be concerned with the loss of agricultural soils within valleys. In the river valleys, the soils are very highly ranked and desired for their productivity. A new hydro dam would create a great loss of soils. Farmers have shown interest in the use of micro hydro to generate power for remote agricultural activities such as powering an electric fence, pumps for moving water to livestock and lights for out buildings. The VAAFM is supportive of the potential for microhydro installations that would have very limited impact on soils.

Method to Mitigate

The VAAFM would request the following.

- The VAAFM should become a "party by right" in the section 248 process and would be granted "bill back" authority for the involvement in applications.

Recommendation for siting and design

- Hydro developers should avoid all USDA ranked soils (agricultural value groups 1 through 8 and soils that are an active part of a farming operation) when siting the hydro projects.
- Indirect impacts and access to USDA ranked soils should be determined and avoided as part of the siting process.
- The impact of infrastructure should be limited even on unranked soils and limit use of cement/concrete ballasts or wholesale paving of significant farmland.
- Land should not be altered through scraping or grading.
- At the end of the useful life of the installation all infrastructure should be removed, without reducing the agricultural potential of the ranked soil.

Electric-led Biomass

The VAAFM is very supportive of the use of biomass and wood for fuel. The increased requirements for buffers on agricultural soils to protect water quality may provide a new cash crop for farmers. Grasses as well as woody biomass would be planted in the buffers and harvested once per year for energy production. These crops would provide soil retention and stream bank protections and could be established with limited tillage. The VAAFM is also supportive of farms utilizing other agricultural soils in the production of grass and wood biomass for energy production.

Method to Mitigate

- Farms should be encouraged to utilize land to grow biomass as a part of a viable farming operation.

Recommendation for siting and design

- Farms should utilize buffers as well as dedicated farmland to produce biomass crops as part of a viable farming operation.

Anaerobic Digesters

The VAAFM is extremely supportive of the use of anaerobic digesters in the management of manure and feedstocks on Vermont farms. This anaerobic digestion is a base-load power generator and with further treatment of the resulting solid and liquid effluent, can meet several water quality goals. At this point in time, all anaerobic farm based digesters are located in the farmstead complex of dairy farms. The soils around these complexes are already impacted by farm buildings and the installation of the anaerobic digesters has a limited additional impact on agricultural soils.

Manure that is digested anaerobically has many positive environmental impacts.

- The collection and digestion of manure reduces greenhouse gas emissions.
- The burning of the methane gas generated provides base load power.
- The resulting effluent when separated can provide bedding for cattle and a liquid that can be utilized as nutrient for growing crops.
- Odor is vastly reduced when spreading liquid from a digester compared to raw (unprocessed) manure.

New techniques are being implemented to further reduce nutrients such as phosphorus and nitrogen from the liquid effluent portion. This can tailor the liquid effluent being returned to the farm fields to limit a nutrient that is in excess such as phosphorus.

Method to Mitigate

If an anaerobic methane digester will not be located in the farmstead complex, then the installation should avoid ranked soils as described earlier.

- The VAAFM should become a "party by right" in the section 248 process and would be granted "bill back" authority for the involvement in applications.
- The VAAFM would support the location of anaerobic digesters within the farmstead complex.

Recommendation for siting and design

The VAAFM would support siting of anaerobic digesters within the farmstead complex on farms. If the anaerobic digester will not be associated with a farm, the construction of the anaerobic digester should occur with limited or no impact on ranked agricultural soils.

5.6 AESTHETICS

Aesthetics Review in 30 VSA § 248

In 30 VSA § 248 (Section 248), aesthetics is primarily reviewed in the context of criterion (b)(5), which requires that a project "….will not have an undue adverse effect on esthetics, historic sites, air and water

purity, the natural environment, the use of natural resources, and the public health and safety…." [emphasis added]. The Public Service Board uses the two-part Quechee test adopted by the former Environmental Board (now the Natural Resources Board) to determine the project's effect on aesthetics. The Quechee test can be summarized as follows:

Part One: Determine whether the project will have an adverse impact on aesthetics and the scenic and natural beauty of an area because it would not be in harmony with its surroundings. If yes, move to part two.

Part Two: Determine whether the adverse impact is undue, if any one of three questions is answered in the affirmative:
1) Does the project violate a clear, written community standard intended to preserve the aesthetics or scenic, natural beauty of the area?
2) Does the project offend the sensibilities of the average person?
3) Have the applicants failed to take generally available mitigating steps that a reasonable person would take to improve the harmony of the proposed project with its surroundings?

The Board also considers the societal benefits of a project as part of its application of the Quechee test. Section 248 provides in subsection E that, "The Agency of Natural Resources shall appear as a party in any proceedings held under this subsection, shall provide evidence and recommendations concerning any findings to be made under subdivision (b)(5) of this section, and may provide evidence and recommendations concerning any other matters to be determined by the Board in such a proceeding." Historically, and for reasons that are not entirely clear, the Department of Public Service (Department) has provided evidence and recommendations to the Public Service Board (Board) on the aesthetics component of the (b)(5) criteria. The Department does not have any in-house aesthetics expertise, and thus must outsource aesthetic review of projects. The following issues and recommendations are based on the Department's involvement in the review of Section 248 applicants' aesthetics evidence, the evidence provided by the Department's contracted aesthetics experts, and the decisions handed down by the Board.

Aesthetics Issues and Recommendations

<u>Agency Expertise</u>
The agency responsible for evaluating aesthetics and providing input on aesthetics to the Board in Section 248 proceedings should have in-house expertise. If the Department is the proper agency to house aesthetics review, that should be clarified. It may be possible for several agencies involved with aesthetics review to share an expert (e.g., the Department of Public Service and the Division for Historic Preservation in the Agency of Commerce and Community Development).

<u>Standard of Review of Aesthetics in Section 248</u>
Additional evaluation would be needed to determine whether the Quechee test needs updating. Act 99 of the 2014-2015 legislative session prescribed a particular manner of conducting the Quechee test for solar net metering projects 150 kW-500 kW, starting in 2017, which may or may not align with the current method of review currently employed by the Board for all projects, regardless of type or size. There are unresolved concerns expressed by various parties with respect to the treatment of public vs. private views in the second element of Part Two of the Quechee test (whether the project offends the

sensibilities of the average person), and also whether the Board is properly interpreting what constitutes reasonable mitigation.

Section 248 Process

The rules and requirements for different sizes and types of renewable energy projects seeking permits under Section 248 are disjointed and lack clarity regarding applicable statutory criteria, requirements for application completeness, information required to demonstrate compliance with the statutory criteria, and the process and requirements for submitting comments, requests for intervention, and hearings. Additionally, towns, neighbors, and parties require sufficient opportunity and time to comment effectively on CPG petitions and applications. This can be of special concern to those wishing to raise concerns about the aesthetics of a project. Aesthetic concerns are not necessarily commensurate with the size of the project, though the size of the project (determined by energy capacity) usually determines the process and associated notice and comment periods a project is required to use.

Technology-Specific Issues

Solar: Solar projects have been developing at a rapid pace over the past couple of years, due both to dramatic drops in project costs and the existence of (and looming expiration of or changes to) important state and federal incentives. Towns, developers, and state agencies are gaining a better understanding of the factors that make a project well-sited or not. Many of those factors can only be evaluated with respect to a particular site and cannot be generalized. Because sites are selected by developers prior to a project applying for Section 248 approval, the factors that add up to a "good" site or a "poor" site are to a large degree built into a project at the time of application. Once an application has been filed, aesthetic concerns can be addressed by opposing a project outright or at the margin, through screening or minor adjustments to array location.

Act 56 included provisions to improve the ability of towns to have a say in the siting of solar projects. The Act granted automatic right to party status in Section 248 proceedings to host-town selectboards and planning commissions, created statewide setbacks for ground-mounted solar projects, and allowed municipalities to adopt solar screening bylaws that would be applied in the context of a Section 248 proceeding. Towns have only just begun to take advantage of these provisions, so it is too soon to tell if they are achieving their purpose.

In addition to screening and setbacks, stakeholders in the solar siting discussion have suggested a number of potential pathways to direct solar projects to sites that raise fewer aesthetic objections. These range from industry-led initiatives (implementing a "good neighbor" policy) to financial incentives (for projects to locate in the built environment, or co-locate in town-designated solar areas), to regulatory and planning tools (vetting potential preferred solar sites, examining cumulative impacts, and requiring analysis of alternative sites in the Quechee test). The Department supports a number of these pathways, including but not limited to:

- Expanding regional energy planning beyond the pilot phase to all Regional Planning Commissions, including the creation of solar suitability maps that account for resource potential, natural resource and other constraints, and reasonable proximity to transmission.
- Incentives for net metering and Standard Offer projects to site in the built environment including rooftops, parking lots and brownfields.
- Allowing projects to co-locate in town-designated solar areas, and streamlining permitting for these projects and those that benefit and have the support of towns and neighbors.

- Revising notice and comment periods for towns, neighbors, and state agencies to provide meaningful input into the siting of projects.
- Providing for post-construction aesthetics compliance review, potentially under the auspices of host towns.
- Using conditions imposed in previously issued Certificates of Public Good for solar projects, work with Public Service Board and stakeholders to develop standard CPG conditions for CPGs for solar projects, to be included as applicable depending on the size and specific facts of a project.

In terms of specific solar project aesthetics guidance and recommendations, the Department submits as Appendix C to this report the comments made to the Solar Siting Task Force by two aesthetics consultants with we regularly work: Jean Vissering (*Issues and Recommendations for Solar Siting*) and David Raphael (*Guidelines for Siting Solar Energy in Vermont*).

Wind (and other Technologies): The Board uses the Quechee test as described above for wind and other technologies, with the caveat that for smaller wind turbines under 150' in height, there is a rebuttable presumption that there is not an undue adverse aesthetic impact. Because large-scale wind projects cannot be screened, there are aesthetic impacts. Those impacts have been reviewed under the Quechee test for each of the large-scale wind projects in Vermont: in Searsburg , Sheffield, Lowell, and Georgia/Milton. The dockets corresponding to these projects provide insight into the application of the Quechee test to large wind projects.
A number of experts and commissions over the last fifteen years have contributed to the dialogue around wind turbine aesthetics in Vermont. These include:

- *Commission on Wind Energy Regulatory Policy Final Report & Attachments*
- *Utility-Scale Wind Energy Planning Resources*: This is the product of the Wind Siting Consensus Building Project sponsored by the Public Service Department to build consensus on the appropriate siting of utility-scale wind energy in Vermont, published in 2002.
- *Residential Wind Siting Handbook*: This is a guide to siting residential wind turbines published by the Vermont Public Service Board.
- *Wind Energy and Vermont's Scenic Landscape*: This is landscape architect Jean Vissering's discussion paper based on the Wind Siting Consensus Building Project.
- A Visual Assessment Process for Wind Energy Projects: Landscape architect Jean Vissering wrote this generalized visual assessment methodology for Clean Energy States Alliance in 2011. She looks at effective state and local policies, practices, and methodologies to evaluate the visual impacts associated with wind development projects.

In addition, aesthetics experts David Raphael and Jean Vissering provided comments on large-scale (> 500 kW) energy project aesthetics to the Governor's Energy Generation Siting Policy Commission (Siting Commission), which reported its findings to the Governor and Legislature in 2013. These extensive and specific comments and suggestions are also included in the appendix.

In general, the Department's suggestions above with respect to solar hold true for non-solar net metering projects. For non-solar projects > 500 kW, the Department supports the suite of recommendations made by the Siting Commission, which address aesthetics in the context of the overall Section 248 process. The Siting Commission emphasized the following themes, which were reflected in its suite of 28 mostly interdependent recommendations:

- Increase emphasis on planning at state, regional, and municipal levels, such that siting commissions will be consistent with Regional Planning Commission plans.

- Adopt a simplified tiered approach to siting.
- Increase the opportunities for public participation.
- Implement procedural changes to increase transparency, efficiency, and predictability, in the siting process.
- Update environmental, health, and other protection guidelines (on a technology basis, where necessary).

It is important to note that even adopting the full suite of Siting Commission recommendations will not render large-scale renewable energy projects invisible. Renewable energy is a land use that can compete with other land uses, including viewsheds, and Vermont has a finite amount of land with a widely distributed rural population. Vermont's residents also use energy, which both the Legislature and the Administration have directed should increasingly come from renewable resources. Wholesale export of the aesthetic and other impacts of renewable generation out of state is neither practical nor appropriate. Undertaking planning, improving process, and creating guidelines can help ease some of the conflict around aesthetics, but should not be expected to eliminate it entirely; some compromises will be required in order to move away from fossil-fuel based generation.

6. SUMMARY

Vermont has successfully deployed over 500 MW of in-state renewable electric generation, about half of that comprised of wind and solar built over the past five years. These new generators represent an increasingly visible land use that has stirred appropriate debate amongst Vermonters about their benefits and impacts. Like all development, renewable generation can be built well and with few impacts, or instead built without adequate planning, consultation and design, resulting in greater impacts across the landscape. Act 56, the 2016 Comprehensive Energy Plan and the state's greenhouse gas reduction statutes all suggest that significant additional, in-state renewable generation will be deployed over the next 15 years.

The construction and operation of this new generation can avoid and minimize significant environmental and land use impacts through good planning, site selection and design. The 2016 Comprehensive Energy Plan references a study by three Regional Planning Commissions that found that over 340,000 acres of land in Vermont may be suitable for renewable generators that do not include important natural resources like those discussed in this report (http://solartaskforce.vermont.gov/sites/solarsiting/files/documents/meeting_materials/BCRCEnergyPresentationNovember2015.pdf); the 2016 CEP also suggests that perhaps only 13,000 additional acres of new solar – much on the built environment – and a defined number of new wind turbines are necessary to meet Vermont's goals for in-state renewable generation.

Opportunities exist for planners, citizens, landowners and renewable energy developers to identify locations for new generation that avoid impacts to important natural resources, do not consumer large areas of prime agricultural soil and respect the aesthetic priorities of communities. Identifying these locations will require information, planning and incentives to support siting of projects in locations that may be preferred, but not the least expensive. In addition to the specific recommendation set forth in this report, the following overarching steps should be taken to minimize the environmental and land use impacts of new renewable electric generation in Vermont:

- Increase emphasis on energy planning at state, regional, and municipal levels.
- Incent net metering and Standard Offer projects to site in the built environment including rooftops, parking lots and brownfields.
- Control the pace of new renewable generation deployment to meet RES goals, but to allow communities and regions sufficient time to plan for and identify preferred sites for new generation.
- Prioritize deployment of new renewable generators that contribute to Vermont's in-state GHG reduction goals.
- Prioritize deployment of new renewable generators that avoid or substantially minimize impacts to significant natural resources, forest integrity and prime agricultural soils over projects designed and constructed with greater, avoidable impacts.
- Allow projects to co-locate in town-designated solar areas and streamline permitting for these projects.
- Encourage early developer engagement with ANR, PSD and VAAFM at the beginning of the site selection process, to identify and avoid sites with significant environmental or land use values.
- Encourage early developer engagement with regional planning commissions, towns, and abutters to share information and to direct new generation towards sites supported to extent possible by the community.

Appendix A - NSSEP Harvesting and Procurement Standards

A. Harvest Performance Standards

All NSSEP wood fuel harvested in Vermont, except wood fuel procured under the provisions of ***Section C****, shall be harvested in compliance with the following Harvest Performance Standards:*

1. ***Harvesting Systems and Practices*** *- The following systems and practices shall be utilized on all harvest jobs that will supply wood fuel to the NSSEP facility. It is acknowledged that conditions vary from one harvest site to the next, and that each site must be evaluated individually to determine the practices to be employed that will ensure the greatest benefit to the natural resources at risk of impact.*

    a. *Harvests shall incorporate recognized silvicultural practices, especially regeneration guidelines, based on the stand conditions and landowner objectives. United States Forest Service Guides provide the kind of guidance needed, as well as regeneration guidelines used on Vermont State lands; however, management should be adaptive to include new research findings, particularly in view of the varied nature of Vermont forests as a result of site conditions, past land use, prior management and future change.*

    b. *All down woody material that existed prior to the start of current harvest operations shall be retained for all harvests. Exceptions to this requirement can be made in consultation with and upon approval from the Agency's Department of Forests, Parks and Recreation ("FPR") in certain, limited situations (e.g., a large storm has recently downed a significant number of trees at a proposed harvest site).*

    c. *Where whole tree harvesting occurs, harvest plans shall incorporate the following retention matrix, which must be implemented for all whole tree harvests:*

For a Harvest of:	*Drop and leave a minimum of:*
Less than 50% of total basal area	*2 trees > 14"diameter at breast height (dbh)/acre, OR* *4 trees > 6" dbh/acre*
More than 50% of total basal area	*4 trees > 14"dbh/acre, OR* *6 trees > 6" dbh/acre*

d. *Harvests shall implement "Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont" (AMPs).*

e. *Harvesting equipment shall not be operated in conditions or in such a manner as to substantially alter the natural and productive properties of the soil. Any significant (i.e., readily observable) compaction, rutting, ditching, draining, or other soil disturbance shall be limited to skid trails, landings, gravel pits, and truck roads.*

f. *No more than 12% of the harvest area shall be used for skid trails, roads and landings.*

2. ***Wildlife Habitat and Natural Communities*** *- The goal of forest management regarding these and other unique resources is to focus on those management practices that maintain or enhance their respective ecological integrity and function.*

a. *Harvest plans must show, and harvest practices shall take into account, the existence and protection of habitat for rare, threatened and endangered species, critical mast sites that show concentrated use by wildlife, and deer wintering areas.*

b. *Harvest plans must also show, and harvest practices shall take into account, the existence and protection of wetlands, significant vernal pools, and S1, S2, and S3A/S3B Natural Communities as mapped by the Agency and updated quarterly.*

c. *Snags are recognized to be valuable wildlife habitat features as well as considerable safety risks on logging jobs. Snags that are not considered safety risks by the timber harvester or according to Occupational Safety and Health Administration standards shall be retained at snag retention levels contained in* ***Appendix A****. If no snags are to be retained, justification must be provided.*

d. *Live cavity trees are recognized to be valuable wildlife habitat features and their retention is desirable. Recommendations for cavity tree retention are contained in* ***Appendix A****. If there are no pre-existing cavity trees, this shall be noted in the harvest plan. If no existing cavity trees shall be retained, justification must be provided. If necessary, provisions for recruiting new cavity trees should be included.*

3. Invasive Plants

a. *Timber harvesting equipment shall be cleaned of soil and plant material prior to delivery to a harvest site. The purpose of this requirement is to minimize the*

spread of invasive species by reducing the transportation of seeds and plant material.

b. *Where existing invasive plant populations are likely to respond to increased sunlight or soil disturbance, conduct appropriate pre-treatment of infestation before commencing harvesting.*

c. *Harvest plans shall address control and management of invasive plant species to the maximum practical extent.*

4. Historic Resources

a. *Flagging or other adequate methods of marking shall be used to increase the visibility of historic resources on the harvest site prior to commencement of harvesting operations. The flagged area shall include any additional area around the historic resource that must be managed so that the historic character of the resource is not unduly altered.*

b. *The timber harvest crew shall be made aware of the location of any historic resources and any necessary protection measures to be used to ensure that the historic character of the resource is not altered.*

c. *If stone walls must be crossed, use existing openings; or, cross in as few areas as possible, retaining stones for possible reconstruction.*

d. *Trees shall not be felled on stone walls, foundations, or other historic resources wherever possible.*

e. *Refer to and follow the Vermont Division for Historic Preservation publication, "Stewardship Guide for Historic and Archeological Resources" for information on practices for preserving historic resources.*

5. ***Monitoring Forest Health***

a. *Include provisions to achieve the monitoring objectives contained in* ***Section E.5.***

B. Best Management Practices to Mitigate Risk of Human Assisted Movement of Invasive Species with Wood Fuel

The following standards shall be incorporated into all fuel procurement contracts and complied with by all suppliers:

- *All wood fuel procured from outside Vermont shall be chipped prior to importation to Vermont. No round wood from any out-of-state source shall be transported into Vermont prior to chipping.*

- *When procuring or receiving wood fuel from an area of federal or state quarantine requires a Certificate of Compliance issued by the applicable jurisdiction, such Certificate shall accompany each load of chips transported into or through Vermont and delivered at the facility.*

- *Any wood fuel material procured or originating from within a state or federal quarantined area for wood or bark boring insect pests shall be chipped to the 1-inch standard (no greater than 1 inch in any two dimensions).*

- *Any wood fuel material procured or originating from within a 10-mile buffer zone around the perimeter of a USDA quarantined area shall be chipped to the 1-inch standard (no greater than 1 inch in any two dimensions).*

- *Any wood fuel material procured or originating outside a 50-mile radius from the facility, outside of Vermont, shall be chipped to the 1 inch standard. Any wood fuel material procured or originating within Vermont shall be chipped to the 1 inch standard when originating from areas subject to regulation, or from areas within a 10 mile buffer of said regulated areas.*

- *Any procurement of non-forest fuel material (e.g., switchgrass, short rotation willow or aspens) shall comply with any existing or future state or federal quarantine requirements or the chipping standards that may be described therein.*

- *Procurement contracts for Vermont sourced wood fuel shall specifically include notice that Vermont regulatory authorities, including AAFM and the Agency/FPR, have the right to access harvest and chipping sites to conduct pest surveillance activities during reasonable times.*

- *Chips must be transported to the facility in enclosed or covered vehicles.*

- *If procurement contracts for Vermont-sourced material require invasive plant mitigation actions prior to or following harvest through the application of herbicides, such contracts shall require that the supplier comply with provisions in the Vermont Regulations for Control of pesticides in accordance with 6 V.S.A. Chapter 87 and the Vermont Noxious Weed Rule.*

NSSEP shall take all actions necessary to ensure compliance with the following standards at its facility:

- *No round wood from any source shall be accepted or stored at the facility.*

- *Wood fuel material lawfully procured from areas of federal or state quarantine and delivered to the facility shall be segregated from other wood fuel material until burned.*

- *Reject material procured from an area of federal or state quarantine that is transported or delivered without a valid Certificate of Compliance when one is required by law.*

- *Immediately report the movement or attempted delivery of regulated material by a supplier without a required Certificate of Compliance to Vermont regulatory authorities, including AAFM and the Agency/FPR.*

- *Maintain records of procurement, including specific location of origin of material and Certificates of Compliance when required, on site at the facility for a period of three years and make these records available to state regulators during regular business hours and as necessary at other reasonable times upon the request of the Secretary of AAFM in the event of suspected infested material.*

- *Employ foresters on staff to review potential and actual harvest sites, both pre- and post-harvest. NSSEP staff foresters shall conduct and maintain records of pre-procurement contract site surveillance activities to confirm that the boundaries of each harvest site fall within or outside of officially quarantined areas or within or without the 10 mile buffer zone of a USDA quarantined area.*

- *Immediately report suspected pests at a harvest site in Vermont, in feedstock, or observed at the facility, and also report suspected violations of procurement standards related to invasive species by chip suppliers or contractors to Vermont state regulatory authorities, including AAFM and the Agency/FPR.*

- *Burn all wood fuel at the facility within 45 days of delivery.*

- *Develop a site maintenance schedule with safe disposal methods to ensure that chip and wood debris does not accumulate for more than 45 days.*

- *Allow state pest surveillance and educational activities at the facility, including attendance and educational presentations by state regulatory authorities at meetings with the facility's chip suppliers and sub-contractors for the purpose of training in identification of invasive species, on-going review of current and expected regulatory requirements and quarantines, and discussion of emerging trends in pest infestation and threats to Vermont's working landscape from invasive species.*

- *Take reasonable on-going measures to limit and detect the escape of insects from the chip storage sheds, including installation of screening on gable ends and on all vents, use of surveillance traps and "trap tree" species, as recommended by state regulatory authorities.*

C. Other Sources of Wood Chips

*Notwithstanding the Harvest Performance Standards established under **Section A** and Procurement procedures established in **Section D**, NSSEP may procure wood chips from land or development clearing, right-of-way clearing, and right-of-way maintenance, provided those activities have been authorized by the appropriate regulatory process (e.g., Act 250, Section 248) and are conducted consistent with the conditions of their authorization. For all such wood fuel, NSSEP shall obtain a copy of the applicable permits and provide copies to FPR at least 48 hours prior to delivery of wood chips to the facility. NSSEP may also procure wood chips from sawmill residue, storm recovery efforts, or other special circumstances agreed to by FPR on a case-by-case basis where an approved harvest plan is not warranted, required, or exempt from the requirement. Whenever possible, NSSEP shall submit information, including the type of wood chips and their source location, to FPR at least 48 hours prior to accepting the wood chips. When this is not possible, NSSEP shall provide such information as soon as practicable following its acceptance of wood chips.*

*The Best Management Practices to mitigate risk of human assisted movement of invasive species established under **Section B**. shall apply to all wood chips procured under this **Section C**.*

D. Procurement

NSSEP shall include provisions in its fuel supply contracts (including contracts to lower tier subcontractors) that require all contractors and subcontractors to meet the requirements of these harvesting standards.

1. *Prior to entering into contracts for wood fuel supply, NSSEP shall evaluate suppliers and their history of compliance with regulations. As part of this evaluation, NSSEP shall request pertinent information on each proposed supplier from FPR.*

2. *Harvest sites within the State of Vermont that generate wood fuel to be procured by NSSEP shall have a FPR-approved harvest plan in place prior to commencement of any harvest related activities. Wood fuel shall not be accepted from harvesting sites without an approved harvest plan. Harvest Plan approval is discussed in **Section D.7**, below.*

3. *Each executed contract with a wood chip supplier shall provide the following:*

    - *Grant NSSEP the authority to inspect the work sites of the supplier.*

    - *Grant NSSEP the authority to refuse delivery of wood chips for non-compliance with any material condition contained in this document.*

    - *Grant NSSEP the authority to sever the contract for non-compliance with the contract provisions.*

- *Grant NSSEP the authority to request documentation of compliance with applicable laws, regulations, and standards.*

- *For all contracts with suppliers shipping wood fuel harvested in Vermont, obligate supplier to certify compliance of harvest with the harvest performance standards established in* ***Section A****.*

4. *Each wood fuel supplier shall be required to provide the following documentation upon entering the NSSEP facility and prior to unloading any wood supply:*

    - *Harvest Plan Identification Number and/or Timber Stand Number (Vermont based)*

    - *Chip Harvest Registration Number (Vermont based)*

    - *Transportation Manifest (for out of state supply), including the origin of the wood shipment (i.e., State and Township, or most precise location).*

5. *For supply coming from quarantined regions (as defined by State or Federal Animal and Plant Health Inspection Services program) NSSEP shall provide a copy of the Compliance Agreement for harvesting from pertinent State and/or Federal Agencies and comply with the requirements in* ***Section B****.*

6. *Chip Harvesters in Vermont shall be required to be registered as required by 10 V.S.A § 2623(3), as the same may be amended.*

7. *As part of the procurement process, NSSEP staff field foresters shall require harvest plans from consulting foresters/harvesters/landowners for submission by NSSEP to FPR for review and approval.*

    a. *For all harvest sites within Vermont from which wood fuel will be purchased by NSSEP, a NSSEP forester shall visit the site with the landowner, harvester and/or forester and confer in developing a Harvest Plan that meets the Harvest Performance Standards of* ***Section A*** *and the procurement criteria of this section.*

    b. *In turn, the NSSEP forester shall develop a "Harvest Notification" to be sent digitally to the appropriate FPR reviewer. This notification shall include the harvest plan, which at a minimum shall include the parcel and stand information required by the Minimum Standards for Forest Management Plans guidelines developed for the Use Value Appraisal Program (UVA), as well as GIS-based mapping data for the relevant natural resource attributes associated with the harvest site as identified in* ***Sections A.2.a. and A.2.b****. The Harvest Notification shall also address how the harvest will conserve and protect the resource attributes identified in the Harvest Performance Standards.*

c. *FPR will have fifteen calendar days in which to respond to the NSSEP forester with an approval, disapproval or a request for modification of the proposed harvest. No harvesting shall begin before approval by FPR. If FPR does not respond within the initial fifteen day period, the plans are by default approved by FPR.*

d. *If FPR responds with a request for modification, FPR will have up to fifteen additional calendar days to work with NSSEP to determine the plan modifications necessary to meet the harvest standards. A site visit may be necessary during this period, which NSSEP shall assist in facilitating. On or before the fifteenth day, FPR will either approve the harvest plan with conditions or deny the harvest plan.*

e. *In order to support FPR's required review of NSSEP forest plans, FPR's monitoring of forest health, FPR's monitoring of compliance with the harvest performance standards, and FPR's efforts to provide technical assistance to wood fuel suppliers regarding the harvest standards, NSSEP shall provide the Agency with funding in the amount of $200,000 annually. This funding amount shall be adjusted annually by utilizing a recognized inflation index.*

E. Staffing, Monitoring and Training

1. *NSSEP shall employ the necessary number of forestry staff to accomplish the objectives of these standards. The forestry staff shall maintain the minimum continuing education credits as recommended by the Society of American Foresters. At least one staff member shall serve in a supervisory capacity and possess relevant technical and management experience.*

2. *In cases where wood is procured from a State with licensing requirements, the NSSEP staff forester assigned for oversight shall hold applicable licenses as required in that State.*

3. *In order to further the objectives established by these standards, NSSEP's forestry staff shall monitor all procurement contracts and perform functions that promote and support sustainable forestry practices, including but not limited to:*

   a. *Procurement requirements and harvesting standards related to wood fuel supply shall be met by wood chip suppliers, including any applicable quarantine requirements.*

   b. *Notice shall be provided by suppliers to NSSEP at the start of each harvest, and in turn, NSSEP shall provide notice to FPR.*

   c. *Post-harvest inspection of harvest sites by NSSEP foresters shall be conducted on a frequent, rotating basis, reflective of a diversity of geographic, seasonal, forest types, and such other criteria as determined by FPR in consultation with NSSEP, to check compliance with procurement requirements and harvesting standards. The inspections of the harvest sites shall include pre-harvest and post-harvest visits on a representative number of*

harvest sites as determined in consultation with FPR. FPR foresters may accompany NSSEP foresters on harvest site inspections.

d. *Review documentation of geographic origins of wood supplies.*

e. *On a quarterly basis NSSEP shall provide FPR with a summary of the quantity and geographic source (i.e., Township, or the most precise location) of procured wood.*

4. *If during a site visit or at any point during the procurement process NSSEP determines that a supplier has materially violated the procurement policy, NSSEP shall immediately issue a cure notice and notify FPR. The supplier will have 10 business days to cure the violation. If the supplier does not cure the violation NSSEP shall immediately cease receiving materials from the supplier.*

5. *As a method for improving general knowledge of forest changes resulting from harvesting, and to better adjust harvest planning and guidance to protect forest health, NSSEP shall collect and report harvest monitoring data to FPR on a reasonable percentage of operations annually. The percentage of operations where data is collected and the indicators to be utilized will be determined by FPR in consultation with NSSEP. Indicators of forest health to be used in this monitoring effort may include:*

- Management for species and areas of special concern (e.g., deer yards, critical mast sites, wetlands, natural communities)
- Support for biodiversity (e.g., snags, down woody material)
- Support for soil health (e.g., down woody material, soil disturbance)
- Insect and disease quarantines
- Management non-native invasive plants (e.g., prevent spread)
- Regeneration and healthy residual stands
- Observation of climate change adaptation
- Mitigation measures used for minimizing risk of moving non-native insects and diseases

Appendix A

Structural Retention Guidelines for Snags and Live Cavity Trees (from Bio-E Final Report)

Structure	*Minimum Target/Acre**
Live decaying trees 12-18" DBH	*4*
Live decaying trees > 18" DBH	*1*
Snags > 10" DBH	*5*

** Retain smaller trees when suitable trees of these size classes are not present. The highest priority must be safety, with specific regard to OSHA regulations.*

Appendix B - FPR Forest Carbon Fact Sheet

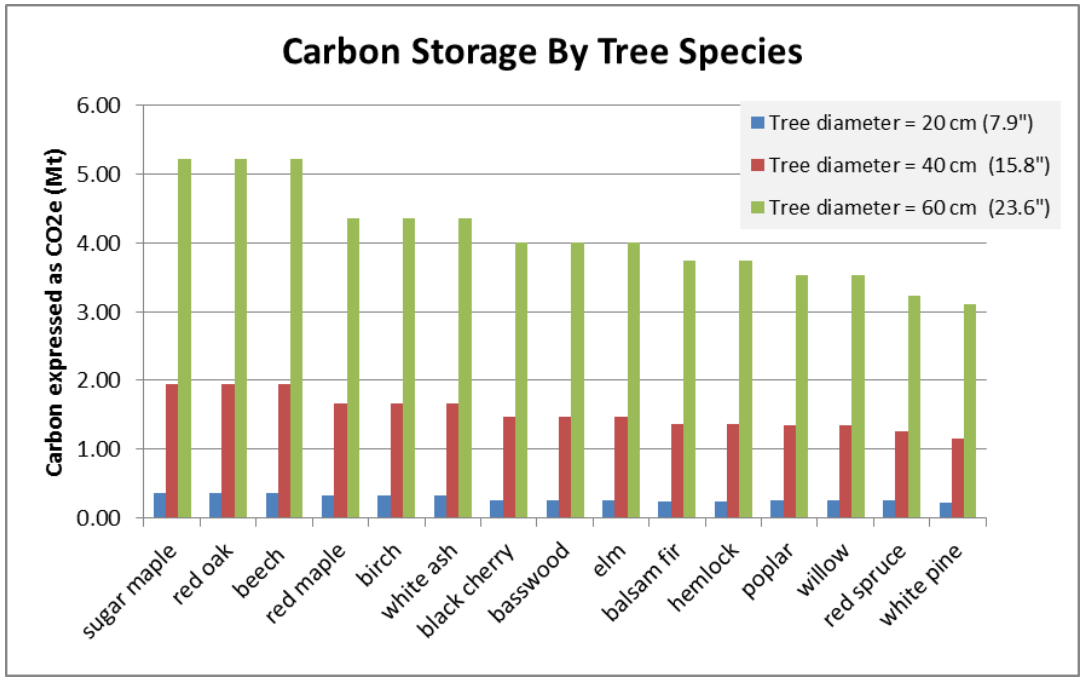
Forest Carbon

Plants absorb carbon dioxide (CO_2) from the atmosphere as they grow, and they store some of the carbon throughout their lifetime. Soils also store carbon, and in some cases may store greater amounts of carbon than the vegetation above ground. Three different aspects of forests and carbon are discussed here: individual trees, individual forests, and forest landscapes of Vermont.

Note: there is a difference between tree uptake of carbon (annual uptake) and tree storage of carbon (over the lifetime of trees). Both will be discussed.

Note: The amount of carbon in trees and forests is expressed here in the same units as our emissions to gage the value of forests to emission reductions.

How much carbon is in Vermont trees?



Trees of different species and ages can differ greatly in the amount of carbon uptake and storage. Hardwoods with dense wood tend to store more carbon than softwoods with lighter wood. Young trees have only a fraction of the amount of carbon stored in older, large diameter trees. Annual uptake of carbon is related to tree vigor and growth rate, so healthy, fast growing trees can accumulate carbon faster.

Figure 1. Illustration of the range of carbon storage based on species and size of trees.

Emissions By One Car Traveling For One Year …

Average Vehicle Miles Traveled per year = 11,318 miles
Average car and light trucks get 21.4 mpg
Each vehicle's annual emissions = 4.75 MtCO2e

Uptake of a 1" diameter conifer growing for 10 years = 0.039 MtCO2e
It would take 121, 1" diameter trees growing for 10 years to sequester emissions from one car.

= Sequestration By 121 Trees (1" diameter) Growing For 10 Years

How much carbon is stored in forests?

Factors influencing the amount of carbon in a forest:

- Size of the forest area
- Number, species and age of trees
- Soil type and depth
- Amount of dead and down organic material
- Disturbances such as insect defoliations or ice storm damage, which can significantly reduce carbon storage in forests.

The range of carbon stored in forests can be large, but the US Forest Service inventory estimates that privately owned forestland stores 77.1 metric tons carbon per acre; public forestland stores 81.6 to 84.6 Mt/A, with the National Forest storing the largest amount per acre.

Vermont forests on average store about 80 MtC per acre (293 MtCO2e) in above ground tree biomass.

Emissions Reduction By One Acre of Forest …

Each vehicle's annual emissions = 4.75 MtCO2e
Each acre of Vermont forestland sequesters 293 MtCO2e

= annual emission from 62 vehicles

How much carbon is stored in Vermont's forestland?

Emissions or sequestration of CO_2 can occur as land uses change. For example, CO_2 is exchanged between the atmosphere and the plants and soils on land when new areas are cultivated and become cropland or as pastureland reverts to forests.

In Vermont since 1990, land use, land-use change, and forestry activities have resulted in more removal of CO_2 from the atmosphere than emissions. Because of this, forests are considered a net sink, rather than a source, of CO_2 over this period. In many areas of the world, the opposite is true: In countries where large areas of forest land are cleared, often for agricultural purposes or for development, this change in land use can be a net source of greenhouse gas emissions.

Statewide greenhouse gas emissions are estimated at 8.37 million metric tons of CO2 equivalent (MMTCO2e) per year. Vermont forests remove an estimated 8.23 MMTCO2e per year. At the same time, storage of carbon in Vermont forests is about 469 MMTCO2e above ground and 1,315 MMTCO2e below ground.

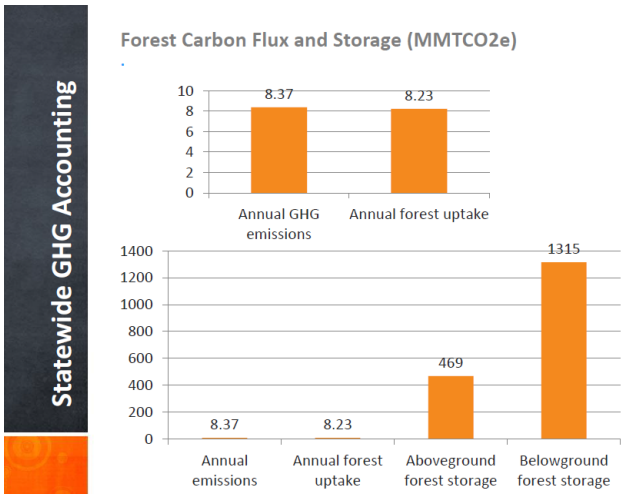


Figure 2. Annual uptake of carbon dioxide by forests (flux) compared to annual greenhouse gas emissions (GHG) (top graph). These same metrics are compared with long term storage of carbon in trees and in soils (lower graph).

Expanding areas of healthy forests will maximize carbon uptake and storage, more than any other land use. Where development does occur, planting trees will minimize carbon losses from soil, and accelerate vegetation growth to sequester additional carbon.

Appendix C - PSD Consultant Aesthetics Reports

Jean Vissering Landscape Architecture
3700 NORTH STREET MONTPELIER VERMONT 05602 802-223-3262/jeanviss@attglobal.net

Memorandum

Date: October 15, 2015

To: The Vermont Solar Siting Evaluation Committee

Re: Issues and Recommendations for Solar Siting

Thank you for the opportunity to pass along some thoughts about solar siting and design. I have been evaluating aesthetic impacts since the 1970's (see my resume attached). In recent years I have served as an independent aesthetics expert for the Department of Public Service, though this letter expresses my own opinions and not those of the Department. To date, I have reviewed at least 35 solar projects for the Department most of them 2.2 MW in size. I have also studied other smaller projects for work I prepared for the Vermont Housing Conservation Board. Most of these solar projects have been well-sited, but an unfortunate few were, in my opinion, poorly sited. Given the speed at which applications are coming in, there is a significant potential for cumulative impacts without planning and reasonable guidance.

In reviewing projects, I have not felt the "Quechee Analysis" afforded me the tools to find that poorly sited projects had an "undue adverse impacts on aesthetics." The "clear written community standard" and "offensive to the average person" tests are high bars, and can be difficult to reach. Take for example, a project located on an open meadow that serves as a scenic foreground to views of distant mountains: most likely it is one of many lovely meadows in town and is not singled out in the Town Plan. "Offensiveness" is hard to measure, and regulators are reluctant to rely solely on this test. "Reasonable mitigation" measures tend to be limited to adding shrub plantings or a less industrial looking fence. State policy and guidance would be a valuable tool.

Vermont has worked hard to encourage development that respects our scenic landscape. Witness, for example the work of Terry Boyle (Office of Terrance Boyle), who developed guidelines for building power lines that have helped to keep this infrastructure's impacts at a minimum compared with other states. State guidelines for development at interstate interchanges have helped defeat some of the worst proposals. Rather than relying solely on a

piecemeal approach, a one-project-at-a-time review, we need sensible guidelines for siting solar projects that encourage developers to select less visually sensitive sites. It is wonderful to see solar power taking off. Now is the time to nudge it in a direction that balances renewable energy development with the protection of valued resources.

General Observations

Before recommending siting criteria, I'd like to mention a few other considerations and concerns:

- As noted above, landscaping too often is the only tool serving as "reasonable mitigation," and this leads to a number of problems. Often the solution is a large number of shrubs immediately around the project fence. Plants must be limited in height so as not to block sun. One of the few smaller evergreen species, white cedar (arborvitae), tends to be eaten by deer leaving ungainly dead branches up to deer head height. Also, these are sites where watering is usually impossible and on-going maintenance is limited. Farmers cannot mow in the planted area so grasses grow up competing with the vigor of the newly planted shrubs. Inevitably some plants die and others struggle. If livestock grazing is permitted, the plantings themselves must be fenced off in order to prevent browsing. The effect can be far from aesthetically pleasing. Additionally, ANR recommends that large meadows open for ground nesting birds like bobolinks and killdeer, and justifiably discourages planting in these areas.
- Developers often control only a small leased area immediately just large enough for the project itself. Plantings may be more logically placed "off-site" plantings, such as along a roadside or supplementing an existing hedgerow, but these are areas "not in the developer's control." Appropriate approaches for landscape screening need to be identified. Developers must retain control over a sufficient area so that landscape screening can be adequately provided for. If insufficient land area is available for landscaping, the project may need to be reduced in size. Guidelines should be established for on-going maintenance and for replacement of dead and dying trees over the life of the project. Compliance with proposed landscape plans is another issue, and I would recommend a post construction assessment of compliance (1-3 years following installation) by the petitioner's landscape architect with a report submitted to the PSB.
- I have found that the visual impacts of associated project infrastructure is too often ignored and not clearly identified on plans or described in documents. This includes the interconnections between the distribution lines and the project. Solar projects may require up to three new power poles or, alternatively, a large transformer unit. These are generally located right next to the road. Often these are poorly planned and executed with equipment slapped up on plywood and without screening. The new

poles are more massive and cluttered than typical roadside distribution poles. In some cases new distribution lines are needed to serve a project site. In addition, inverter structures are large metal boxes that are often taller than the surrounding panels. Unless specified, they are usually white, one of the most visually noticeable colors in the landscape. Better planning and guidelines are needed for this equipment, including the use of appropriate colors (dark gray) and for screening.

- Towns should be aware that the Department and the Board find comments and participation from Town officials to be highly valuable. The participation does not need to involve legal counsel, but a statement of concerns, suggested mitigation (if relevant), and recommended actions provided by a local planning commission or selectboard will be taken seriously. It may be helpful to provide towns with guidance on how to participate and what kinds of comments they can make. It would be also helpful to provide sample language that Towns can include in a Town Plan to ensure that solar projects are appropriately sited and reasonably mitigated.
- At the present time the Department of Public Service focuses primarily on larger solar projects (1MW+), due in part to limited staffing. However, numerous projects between 150 and 500kw are being proposed with little oversight. The cumulative impacts of these projects are becoming noticeable. Guidelines need to include these smaller projects.

Recommended Siting Guidelines

My recommendations are in two parts: 1) siting (location) guidelines, and 2) design guidelines.

1) <u>Siting (Locational) Guidelines</u>

Siting guidelines should encourage developers to select less visually sensitive site. Below is a list of site characteristics that are "desirable" and "undesirable" from the point of view of a visual sensitivity. Encouragement could be given to developers who select "desirable" sites, perhaps by fast-tracking projects. By contrast, developers selecting "undesirable" sites would need to justify the need for selecting a visually or environmentally sensitive location.[1]

[1] Every site has unique attributes, and there are likely to be situations in which a project site with "undesirable" characteristics is nevertheless suitable; or the reverse. For example, although the use of open farmland should generally be discouraged, there are likely to be situations where farmland makes sense for a solar project, e.g the power will be used directly by the agricultural operation itself: the field is not of good quality and has been left fallow for a number of years; the field is well screened from view from public vantage points; or attributes of the site or surroundings reduce the scenic quality of the open field.

Macro-Siting	
Desirable	Undesirable
▪ Commercial and Industrial Sites ▪ Less valuable ag land; reverting to scrub ▪ Sites at least 80% screened by existing vegetation ▪ Areas adjacent to Transmission Lines ▪ Adjacent to Existing Non-residential or non-agricultural development ▪ Adjacent to Existing Hedgerow or Woods Edge ▪ Set back from the roadside by at least 500 feet[2]	▪ Productive Farmland ▪ Open meadows serving as foreground for distant views ▪ High Quality Woodlands/ Productive Timberland ▪ Sites in close proximity to residences (w/i 200 feet), which cannot be substantially screened ▪ Open meadows with bobolinks ▪ Prominent gateway areas to Villages and Towns ▪ Sites requiring new distribution line infrastructure ▪ Sites adjacent to a public road with no screening

2) <u>Design Guidelines</u>

Below are examples of design guidelines, which could help identify minimum standards, as well as what to avoid. More detail may be needed than the bullet list below. For example, guidelines for landscape screening as discussed above. [3]

Micro-siting and Design	
Encourage	Avoid
▪ Location along edge of a field near hedgerows or near existing development ▪ Continued agricultural use of remaining fields. ▪ Project set back from the road to permit other development or land uses in closer proximity to the roadside. ▪ Minimal, well-planned roadside equipment ▪ All Associated Equipment of dark receding color (e.g. dark gray) ▪ No fencing or farm-style wire fencing ▪ Landscape screening where appropriate and requested by town.	▪ Location in middle of open field ▪ Remaining open land no longer suited to agricultural of other uses. ▪ Project location would prevent the remaining land or parcel from being used for future development. ▪ Visually cluttered and unscreened roadside equipment ▪ Associated equipment is white or light in color and visible off –site. ▪ Chain-link fences

[2] Setbacks serve partly to reduce visual prominence of the project, but also may allow development adjacent to the roadside that may be more visually or functionally appropriate.

[3] Good siting vs. relying on screening will be a better approach. In some cases an open meadow at the edges of a solar project may be a simpler and more appropriate solution. In other cases, screening will be a benefit.

Conclusion

The recommendations above represent what I have learned in my experience to date, and certainly some very preliminary ideas. I very much appreciate the Committee's efforts to address this issue. I would be happy to talk with you if it would be helpful.

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Transmittal

To: Vermont Solar Siting Task Force

Date: 9.16.15

Company:

No. of Attachments: 1

Address:

From: David Raphael, Landscape Architect and Planner

Re: Guidelines for Siting Solar Energy Projects in Vermont

❑ reply requested ❑ in response to your request X attachment/enclosure

❑ review/comment ❑ for your information ❑ see remarks below

Comments/Remarks

Please find attached for your consideration a draft copy of a document entitled "Aesthetic and Land Use Guidelines for Siting Ground Mounted Solar Energy Projects". These guidelines have been prepared with the input and guidance of the Department of Public Service. The intent is to reflect the current process for aesthetics review under Section 248 with the added benefit of current thinking and practice in the siting of renewable energy projects.

I hope this will inform and assist the Task Force in its efforts.

Copies to:

Aesthetic and Land Use Guidelines for Siting Ground-Mounted Solar Projects

These guidelines are primarily intended to provide a framework for communities and neighbors in reviewing proposals for large-scale solar energy arrays (150 kW or greater) as well as for developers planning for these types of projects. The guidelines are applicable to smaller projects as well. The purpose of these guidelines is to better anticipate and address aesthetic and land use issues and opportunities associated with planning and constructing larger-scale solar arrays that are interconnected with the electrical grid. The guidelines also may serve as a checklist for local review and citizen input.

Project Chronology for addressing aesthetics when developing a solar project:
1. Pre-application – site feasibility, site selection and outreach
2. Site planning and project layout for 45-day Notice
3. Application for a Certificate of Public Good to include:
   A) Quechee Analysis under Section 248
   B) Mitigation measures proposed
   C) Addressing Orderly Development under Section 248

1. Pre-application - site feasibility and selection - "Location, Location, Location" - The first step in developing a solar project.

Questions and considerations.
The most important step in developing a solar project relative to aesthetics and land use considerations is site selection. Reviewing the potential site(s) in the context of certain criteria, and with an understanding of local concerns and potential effects on neighboring properties helps to facilitate the project review and approval process. Some of the key considerations include:

- What does the zoning and land use plan set forth? Has the community identified this site as being one where energy generation/solar panels are desired/permitted? Or is it a site that might create off-site impacts to neighbors and/or scenic landscapes?
- Context and setting for the project – is it adjacent to compatible uses and does it fit within the proposed project area and adjacent land uses? Is there three-phase power accessible within a reasonable distance?
- What standards exist on a local basis to guide solar project siting and conditions for approval? This is a critical consideration, as a successful solar project should meet applicable local criteria to the greatest extent possible. The Addison County Regional Planning Commission has drafted "Aesthetic and Decommissioning Guidelines Regarding Commercial Solar Projects for Inclusion in Municipal Plans" (acrpc.org) which provides guidance for local municipalities as to how to address solar siting and development within their land use ordinances. Solar energy facilities, as a land use, should not be

excluded from any municipality; rather communities can and should, where desirable, exercise their right to provide recommended areas and districts for such facilities. A model for this is in the way some local ordinances have delineated locations or districts where telecommunication facilities are permitted, and where they are not.

- Are there conserved lands, open space scenic features that may be affected? This step includes the need to understand and address any relevant "Community Standards" (as part of the Quechee Analysis to be applied in a subsequent step). A community standard has been defined in case law as clear language (as distinct from more general statements) intended to protect scenic beauty or community character adopted in a town plan that specifically identifies geographic areas or physical resources that the community wished to protect. (i.e. named summits, water bodies, conserved lands or parks)
- Test against desirable/undesirable conditions
- Is the site a greenfield? Is it an actively used agricultural site with agricultural soils? Is any site restoration warranted? Identifying any potential compatible uses may be a plus for the project (i.e. is it next to or part of an industrial or commercial complex, or is there possibility of allowing grazing on the site?)
- Are there agricultural soil qualities and environmental/natural resource characteristics and constraints that must be identified or satisfied?

Discussion Points:

- Work with towns and individuals to review proposed site(s) in advance. Most Development Review Boards or Zoning Boards/Planning Commissions have provisions for pre-application meetings. These can be very helpful and constructive.
- Consider how a project fits within the existing and proposed development patterns of the project area and community to assess whether the project constitutes "Orderly Development" as defined in Section 248, Title 30V.S.A.
- Developers should consider outreach with neighbors and abutters to introduce the project and to gauge local concerns, if any. This will also allow an opportunity to make refinements or changes to the proposed development plan so as to ensure the project will be more amenable to the local stakeholders and residents; and it allows for their input at an early stage.
- Good Neighbor Policies. The notion of a "Good Neighbor Policy" has been forwarded as a consideration for vetting projects. This implies that the project site and proposed development characteristics does not create more impacts off-site than on-site. It also implies that the applicant/developer/property owner has taken into consideration off-site project visibility and physical change to ensure such visibility and physical change is acceptable and does not diminish the landscape qualities or property values that neighbors have a reasonable expectation will not be diminished.

It is also important to note that state and regional departments/agencies, organizations and aesthetic/land use experts can provide assistance in the pre-

application phase in addressing any potential conflicts or related siting and permitting issues – and to help review sites that may or may not be suitable for the project siting. Also note that these same state and regional departments/agencies, organizations and experts have/can/should provide assistance to municipalities to plan for protecting critical resources, and in establishing siting parameters, scenic resource identification, "standards" that must be observed or incorporated, and, most importantly the identification of suitable locations – perhaps beginning with a matrix that sets forth siting factors and assessment considerations.

2. The Elements or "Ingredients" of a Well- Sited Project

While each site poses both opportunities and constraints relative to the development of solar arrays, the following general characteristics provide some basic ingredients for appropriate (and permit–worthy) solar project.

Some Recommended Basic Ingredients:

- Projects are well sited when they are located at a reasonable distance for access to the grid in a cost-effective manner that does not require extensive additional transmission or collector line infrastructure.
- Projects are ideally sited on topography that is well suited for maximum insolation (solar gain) and amenable for the installation of solar panels in an orderly and/or symmetrical pattern. Such topography is typically level or gently sloping to the south, and not highly irregular in contour or comprised of several different orientations.
- Industrial, brownfield and areas already developed may be better suited to accommodate solar projects than residential or rural sites. However, residential and rural sites may also be amenable under certain circumstances that include:
  1) Adequate screening from neighboring properties coupled with and sufficient setbacks. (The Vermont State Legislature recently set forth in Act 56, Section 26A requirements for setbacks and screening based on specific project locations and scale.)
  2) A site that has natural screening and separation from adjacent land uses and properties resulting in minimal to no off-site visibility.
- The proposed site is not a high-value agricultural or natural resource area, or if so, access and use of those resources is maintained to the greatest extent possible.
- There is community and neighborhood agreement that the site is amenable.

Case study:
The Town of Shelburne developed a "Built Environment – Landscapes & Views Maps" that constitutes a "clearly written community standard" under the provisions of Quechee and is intended for use by developers – including those

developing energy generation and transmission projects. (Contact Dean Pierce at dpierce@shelburnevt.org)

3. Site Planning and Project Layout for 45-day Notice

Array Layout/Site Design:
A number of factors are to be identified at this stage and as basis for pursuing and acceptable site and project design. These factors include:

- Type of Structure to be used – fixed vs. tracker? Pole mounted or ground mounted, or is the project roof mounted –
- Height and scale of the individual panels and structures
- Extent of project footprint
- Layout pattern and what is the extent of symmetry vs. irregularity in the layout?
- Does geography/topography affect the array layout and visual qualities?
- Have sufficient or required setbacks been incorporated? Is there sufficient room for fencing and landscape or visual buffers if needed?
- An initial visibility analysis recommended at this stage.
- Location and configuration within overall site – can the project be sited in a manner that reduces visibility and aesthetic impacts to adjacent properties and sites within the project site?
- If roof mounted, how does the array affect architecture and design qualities of the host structure and its environs?

3. Preparing the Application for a Certificate of Public Good.
The process includes preparing information and analyses that supports the review by all parties to the application.

Visual Qualities and the First Step of the Quechee Analysis.

- A viewshed map is prepared help to identify potential visibility (if not already prepared in Step 2).
- The applicant should prepare and the regulatory body and parties should be able to review the applicable aesthetic assessment principles:
  - Project characteristics as per the First Step of The Quechee Analysis which asks the applicant to identify massing, color, scale, etc., as well as impacts on open space.
  - Landscape character and conditions or affected architectural elements/building structures
  - Identification of sensitive resources
  - Visibility and views from sensitive resources -contrast, dominance, visual presence and absorption
  - Based on public vantage points and primary viewer locations and view factors (i.e. distance, duration, number of potential viewers, etc.)
  - Overall visual effect/change conclusions – does the project harmonize with its surroundings or fit acceptably in the project area? If the project characteristics are such that it does result in noticeable change that affects

or changes positive aesthetic and visual conditions, then the project may be determined to have an adverse impact. The 2nd step of the analysis must then be taken to determine whether that effect, that impact, is unacceptable.

Discuss and address related project elements in this phase of the analysis
The following additional elements should be incorporated into and addressed by the analysis:

- Roads: Access, landscape impacts, efficiency of layout and location
- Undergrounding electricity as a desirable option
- Electrical infrastructure/connections and their visual effects
- Fencing/structures to be part of the project - to house inverters/maintenance, etc.
- Project signage or interpretation

Second Step of the Quechee Analysis.

The second step of the Quechee Analysis considers whether or not a project will have an *undue* adverse impact. This step needs to be addressed if the project is determined to have an adverse impact on the aesthetics of the project area...and this determination would be arrived at as a result of the findings of the first step. Three questions must be satisfactorily addressed at this stage of the review for the project to be acceptable with regard to aesthetic impacts, and they include:

1. Is the project shocking or offensive to the average person?
2. Does the project violate any "clearly written community standards"?
3. Has the applicant employed reasonable measures to mitigate the potential impacts of the project?

1. Is the project shocking or offensive to the average person?
This may considered to be a highly subjective consideration, but if it appears as though the project is truly objectionable when viewed or experienced by individuals with no interest or stake in the project, then it might be considered shocking or offensive.

2. Does the project violate any "clearly written community standards"?
The second step asks if the Project is not consistent with any "clearly written community standard" designed to protect aesthetics, land use (conservation) and scenic values. This issue should be addressed early on in the site planning process as suggested in the site selection section of these guidelines.

3. Has the applicant employed reasonable measures to mitigate the potential impacts of the project?

Mitigation Measures.
Mitigation is an important consideration with or without having to satisfactorily address the Quechee Analysis. Reasonable mitigation measures should always be

employed to reduce environmental and visual impacts. Some mitigation considerations include:

- Buffers, screening, vegetation and landscaping
- Local benefits and educational/interpretive values
- Siting revisions/future development or decommissioning
- Multiple benefits and/or uses for the site

Case Studies: Two early large scale (1 MW or greater) solar projects, were developed along Route 7, the Ferrisburgh Solar Farm (1MW) and in South Burlington, the South Burlington Solar Farm on Dubois Circle (2.2 MW), demonstrate some of the principles of effective siting, neighborhood/local outreach, and project planning to address or mitigate any off-site impacts. (*further narrative and links here*)

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October 24, 2012

Executive Office of Governor Peter Shumlin
109 State Street, Pavilion
Montpelier, VT 05609

Commissioner Elizabeth Miller
VT Department of Public Service
112 State Street, Drawer 20
Montpelier, VT 05620-2601

RE: Governor's Energy Generation Siting Policy Commission

Dear Governor Shumlin and Commissioner Miller;

As one who supports your administration's policies with regard to renewable energy, I was heartened to see that you have appointed a commission to further study the state of renewable energy development in Vermont as well as the Public Service Board's role in the permitting of grid scale projects and related energy development and transmission infrastructure. This is a recommendation I actually forwarded to the Commissioner during the outreach process for the development of the state's energy plan; I am also on record before the PSB as stating that I did not believe the Quechee Analysis, as currently employed, anticipated these types of projects and therefore provides an imperfect platform for their review.

As Principal of LandWorks I have been professionally involved in a wide range of energy related projects throughout New England. We were the aesthetic consultants working for the Department in the successful effort to bury the PV20 line adjacent to the Route 2 Causeway in Milton/South Hero (In a meeting with Governor Dean in his office during that time he looked me straight in the eye and said "you will see that the line is buried, right David?". Needless to say I was relieved that the PSB affirmed our arguments!) We were also the Department of Public Service's consultants in the review and permitting of projects such as the Searsburg Wind Farm and the Northwest Reliability Project. Currently we have been working for the State of Maine in developing protocols for the review of cumulative impacts from wind energy projects and in the review and permitting of individual wind projects. We have and are working for state utilities (Green Mountain Power - Kingdom Community Wind) and regional utilities (Northeast Utilities - ongoing projects) in visual and environmental impact assessment. We recently assisted the Town of Shelburne in developing protocols for the review and protection of scenic and historic resources, in anticipation of energy and utility projects, and the Town of Charlotte in their review of a proposed solar farm on Charlotte-Hinesburg Road. As such, we have extensive experience studying the inter-relationships of energy development, community character, visual and aesthetic impacts and the costs and benefits associated with these types of proj-

ects.

A number of key considerations that I would forward to you and the Commission include:

• The testimony of the Conservation Law Foundation's expert on the viability of grid scale wind energy is as cogent an argument for this form of renewable energy that I have heard. I will email a copy to the Commissioner;

• Concerns with regard to the requirement of town approval for an energy project to go forward - it strikes me that this is the very reason these decisions are rightfully in the province of a state regulatory body - most towns, when given the opportunity, will listen to the vocal and passionate opposition that exists for almost every proposed project - and will not support the implementation of such projects. I would wager that the NRP would never have been built for example, if individual towns had veto power. There does need to be, however, a viable and meaningful participation opportunity for towns;

• The need to take a long distance view of where grid scale wind energy can be built with minimal aesthetic impact - a statewide viewshed and land use analysis might be a starting point for addressing this overarching question of where?;

• The need to strengthen town plans and documents to address where energy projects can and where energy projects cannot be suitably developed. This will require a concerted and defensible basis by which to identify and protect valued scenic and cultural resources from potential impacts. Town plan prohibition of renewable energy types is a dangerous precedent - there is a reason why towns cannot prohibit telecommunications facilities, although they can and should provide standards and guidance as to siting and mitigation;

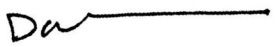
• The value of an impartial presentation and understanding of the actual impacts of wind, solar biomass, hydro and transmission projects - there is so much hyperbole and unsubstantiated information about impacts that we truly need to establish an objective baseline- with regard to effects on tourism, property values, health and recreation - and these should be based on actual studies and evaluations - perhaps of the projects already built in Vermont;

• A robust examination of mitigation options, examples and their application and efficacy - to include everything from purchase of conservation lands and private homes - to education - to landscape plantings and restoration; and

• It will be important to consider an advisory group to the Commission - the Commission is comprised primarily of former public sector officials - a broader perspective is necessary, one that includes the input of utility representatives, developers, local officials, environmental organizations, experts, and perhaps even, in the parlance of the Quechee Test, the "average person".

Finally, I would welcome an opportunity to share with the Commission our experiences in Vermont, Maine, Massachusetts, New York and New Hampshire with regard to energy, aesthetics and community character. I believe I can provide a unique perspective that will help to advance both the discussions and the solutions. I do hope I will have that opportunity.

Respectfully,



David Raphael MLA, ASLA
Registered Landscape Architect
Planner

Lecturer
Rubenstein School of Environment and Natural Resources
University of Vermont

Chair
Planning Commission and Development Review Board
Town of Panton

cc: Ms. Sarah Hofmann, Deputy Commissioner

Jean Vissering Landscape Architecture

3700 NORTH STREET MONTPELIER VERMONT 05602 802-223-3262/jeanviss@attglobal.net

Date: January 30, 2013

To: Vermont Energy Generation Siting Policy Commission

Re: Comments

Thank you for the opportunity to comment. I've attached my resume which includes my experience as a landscape architect in energy issues. I have worked with developers, towns, regional planning commissions, citizen groups and organizations concerning the siting and design of energy projects. I am currently on contract with the Department of Public Service to provide an independent review of those facilities seeking a CPG that may involve aesthetic impacts. I have developed methodologies for evaluating wind energy projects for the Vermont Public Service Board, the National Academy of Sciences, and the Clean Energy States Alliance (with a grant from the US DOE). Over the years I have reviewed numerous energy related projects including wind, solar, biomass, and gas as well as substations and transmission lines.

My opinions about energy projects have evolved over the years and I will share with you my current thinking and observations regarding siting and energy project review, with particular focus on wind and solar. I begin with some general comments about how we can provide the Public Service Board (PSB) and the citizens of the state with a better framework for decision making. Then I will make specific comments on the siting, design and review of wind and solar projects.

General Comments

In general I think the Section 248 process works well for the review of energy projects, but there are areas where improvements are needed. Some of my recommendations focus on providing a better framework within which the PSB makes its decisions. This would require the Public Service Department (DPS) to take a larger role in providing planning, guidance, research and assisting interveners in the process. Town and regional planning commissions also need to play a larger role.

- **Energy Planning**

  The Department of Public Service (DPS) may need to play a larger and more comprehensive role in energy planning. As our energy sources become more localized and distributed, different impacts have emerged than were envisioned years ago. Wind in particular has been extraordinarily divisive. The environmental and aesthetic costs are readily observable (turbines in many views, roads along ridges) while the public appears increasingly uncertain of the benefits as a result of numerous competing and contradictory studies (extent to which

they reduce carbon, produce harmful noise, reduce property values, etc.) DPS could serve several roles:

- Serve as a clearinghouse for research and information that is legitimate and peer reviewed, possibly even commissioning its own research into the actual impacts of existing projects (noise levels, reducing clearing and grading impacts, wildlife, runoff and erosion, etc.)
- Examine energy alternatives: can we meet our energy goals with a limited number of wind projects for example, or through smaller projects (e.g 3-7 turbines) vs. larger wind projects (e.g. 15-30 turbines); by combining in-state and out of state renewables, by emphasizing solar over wind, etc. What would these alternatives look like and what would be the costs and benefits.
- Provide Siting Guidelines (locational criteria) and Best Practice Guidelines (construction and design criteria) that provide guidance for developers and the PSB. These would need to be updated every five years or so to adapt to new technologies and research, and to address problems that have been identified.
- Provide ways to help towns and non-profit organizations participate in the 248 review process without needing huge investments in hiring legal counsel.

- **Siting Guidelines**

Siting Guidelines would identify sites or site characteristics that are appropriate for particular energy projects, and those which would raise red flags or be inappropriate[1]. These need to be resource based. Possible siting criteria are discussed in more detail for wind and solar below. We are beginning to form a reasonable picture of the kinds of sites that are being considered, and the issues that arise. We should be able to put together a matrix of potential concerns along with their priorities. ANR is working on a study that will identify priority resource lands including unfragmented habitat. Towns can be encouraged to identify particularly valued high elevation habitats or lands that are suited and unsuited to larger scale solar or wind farms. A collaborative exercise similar to the meetings DPS sponsored in 2002 in which stakeholders participated in a series of meetings in the early days of wind energy could be one way to begin this process.

- **Best Practice Guidelines**

We are already beginning to develop informal standards including for conducting impact assessments and for project construction and design, but these are not clearly identified in any documents. By incorporating best practice standards, projects would hopefully become more acceptable and provide less cause for complaints.

Some past examples of such guidance include a report prepared in the 1970s by Terry Boyle on siting and designing electrical transmission line corridors. It was because of his study that our electric lines have been much less intrusive than in other states. I don't remember who commissioned the report, but it became the guideline for siting from then on. Similar recommendations were made during the Dean administration for roadway planning that helped to narrow and reduce the size and impacts of new roads (unfortunately not always) and to change highway design standards as they pass within our town and village centers.

[1] The term *siting guidelines* is often miss-used to simply refer only to design criteria such as setbacks, landscaping, etc.

This process was the result of the collaborative efforts of many stakeholders and professionals.

- **Cumulative Impacts**

Few if any methodologies exist for evaluating cumulative impacts, but these will be essential to develop, particularly in addressing larger scale wind, solar, and biofuel projects. Identifying cumulative impact thresholds needs to occur both at the planning level and in the 248 review process. I have discussed this in more detail below regarding the cumulative aesthetic impacts of wind and solar (addressed primarily through appropriate siting).

- **Local Participation/Town Plans**

Local participation will be essential at many levels from planning to participation in the review process.

  - Towns need to be encouraged to consider the appropriate siting of large solar and wind projects. A clear rationale should be provided in identifying sites where energy projects should be excluded. Sample language might be helpful to provide to towns.

  - I have some concerns that the "clear written community standard" under the Quechee Analysis has become so narrowly interpreted that it is nearly impossible to develop language that will pass muster as a standard. This makes towns feel as though their concerns are ignored. Developers, on the other hand, need a reasonable sense of what is expected. Siting guidelines and best practice standards prepared with the participation of towns and regional commissions may help to address some of the common concerns.

  - Towns should be notified of all energy projects proposed within their boundaries including solar projects under 10MW. As noted below, these are fairly large objects appearing throughout the landscape. In cases where they are poorly sited, the zoning administrators get questioned by citizens and have no idea how these were reviewed or what considerations determined its approval. Often a local planning commission can provide advice that may lead to better siting of these projects. (I am speaking here as vice-chair of my local planning commission.)

- **Facilitating Intervener Involvement**

Fully participating in the 248 process can be prohibitively expensive for towns and non-profit organizations and yet these are often voices that should be heard, particularly when there are clear issues involved that are of meaningful concern. Particularly important are those interveners who represent a significant group of people. Many organizations and towns are hesitant to participate without legal counsel as these proceeding can be intimidating and they want to be sure not to create problems down the road.

One possible way in which these concerns could be heard would be to sponsor an informal meeting near the beginning of a review process in which DPS and PSB representatives and interveners representing a larger public (e.g. towns and non-profit organizations) could, along with the developer have an open and informal discussion

without legal representation in the room. This might be an equivalent to a "sketch plan review." Since the concerns of public agencies and non-profits are often different than those of abutting landowners, a similar meeting could be held with abutters within the local community. The intention would be for the various interveners to be heard without refutation in an informal setting. Understanding points of agreement, disagreement and potential solutions or alternatives should be encouraged.

A second approach could be for DPS to have a 248 Omsbudsman who would help to shepherd interveners through the process, possibly acting as a public advocate in certain circumstances.

- PSB Website

Compared with New Hampshire, I have found it very difficult to find documents (other than orders) on the PSB website. In New Hampshire every document that comes in related to a Site Evaluation Commission (SEC) case is posted on a web site in the order it arrives. The site is easy to find. I have found that the PSB may post initial documents but later rebuttal testimony can be very difficult to find. Orders for any project tend to be scattered everywhere (usually by date which is not helpful to most people).

Wind Energy

Wind energy has undoubtedly become one of the most divisive environmental issues the state has faced in a long while. This is in part because projects occupy such prominent and visible locations and extend over a considerable distance. They are also located on what are often highly "valued" locations either because they are part of a common view or because of our general attachment to mountain ridges and the sense that these are "wild" landscapes.[2]

My general feeling is that wind energy needs to be part of the Vermont landscape. We are blessed with abundant scenic beauty but we need to do our share with climate change. Still, I think we need to proceed with caution on wind energy. Two of my concerns are: 1) the machines are so large that it won't take many projects to make it hard to find places, especially mountain summits, from which they are not visible; and 2) utility scale wind projects involve significant alterations to mountain ridgelines for roads and turbine pads. We have to learn from the projects we've built and we need to be sure we get it right.

Many people oppose them automatically based on what they hear about them and without ever having seen one. There is also a fear that they are going to be built all over the state and that we will be seeing them on every hill top. Siting guidelines will be essential (see below). We also need better information about the link between these projects and the real contributions they make to reducing carbon within Vermont and within the larger New England region. If we are going to look at turbines out our windows and build roads along our mountain ridges, we need

[2] Wind energy is also complicated by the fact that some people find them beautiful and others ugly industrial machines. When evaluating aesthetics however, the issue is not whether any individual finds them beautiful or ugly, but rather, what resources are involved in that landscape and how will the project affect those resources.

assurance that it will make a meaningful difference. At present there are too many conflicting studies.

Wind Siting and Design Considerations (Examples)

Roads

Building roads in rugged high elevation settings isn't easy. It requires many curves and considerable cut and fill. Although they aren't particularly visible to most people (except when viewed from above such as from a mountain summit or the Long Trail), the idea of this level of terrain alteration in areas that have been relatively wild and untouched (except perhaps for logging roads) is disturbing to many people.[3] We need to figure out how to build projects with minimal site disturbance. This may require:

- Requiring construction and design techniques that minimize site disturbance. The Lowell and Sheffield projects appear to have resulted in far different levels of site disturbance and may provide lessons for the future.
- Selecting sites which require minimal regrading such as those with limited topographic change and close to or including existing roads.
- Selecting sites which have already been disturbed, for example by logging roads.
- Requiring sites to be under 2500 feet in elevation (or lower in certain circumstances).

Project Size

One question worth exploring is whether we should encourage more smaller projects (3-7 turbines) or a few large ones (15-25 turbines). Advantages of smaller projects would be that they can often be accommodated on lower, smaller ridgelines. Aesthetically these are more likely to appear as part of numerous hills or mountains rather than dominating a major ridgeline throughout a region.

Noise

Noise produces a lot of concern, much of which may be unwarranted beyond a half mile away. But we need better studies on this including examining sound (audibility) as well as noise (above identified thresholds). Many people assume that when a noise assessment finds no impact, that it means there will be no sound at all. So we need to talk honestly about sound. Identifying sound qualities in valleys and on opposite hillsides will be important.

- Get good data based on existing projects and their effects at varying distances and elevations.
- Be sure to analyze both sound and noise (above acceptable levels)
- Keep projects a reasonable distance from residences unless compensation is provided.

[3] It is true that the amount of disturbance for the 21-turbine Lowell project equaled about the same as the area required for one 2.2MW solar project (each Lowell turbine is rated at 3MW). However solar projects are usually located on already disturbed land and/or land zoned for commercial or industrial development. They also usually require minimal regrading.

Lighting
Lighting is often identified as one of the most visually disturbing parts of wind projects. With the new radar activated technologies this impact can be significantly reduced. However, it is not yet clear where the FAA will approve these kinds of systems. In Vermont where the lack of night lighting is such an important characteristic of most of landscape, the ability to employ a motion activated collision avoidance system (e.g. OCAS) will be an essential siting criterion. (This was identified in the 2012 State Energy Plan.)

Cumulative Impacts
I have seen no good methodologies for evaluating cumulative impacts but I believe we can create one. We have traditionally conducted visual assessments using a 10-mile radius around the project. Wind projects are visible up to about 20 miles away, but beyond 10 miles they become a much smaller part of any particular view. Certainly when any 10-mile radii intersects with another project's 10-mile radius, this should raise a red flag and require studies of any cumulative impacts including the number of resources affected and any resources from which both projects might be visible. As part of general planning we may want to limit the number projects of a certain size within any one region.

Importance of Wild/Natural Areas
In terms of sensitivity in evaluating the aesthetic impacts of wind projects, I believe we need to give the highest priority to places valued for an experience of nature. These are the areas we go to in order to get away from civilization. They include hiking trails, for example the Long Trail, publically accessible natural areas, and lakes or ponds which are largely undeveloped and accessible primarily to non-motorized boats. Such places are unique and irreplaceable. Most involve a commitment of public funds. Some of these areas are entirely forested and visibility would be limited. But where views exist, especially if they are relatively close and include a large number of turbines, and the view is otherwise predominantly natural in character, this should raise concerns. In my opinion, these natural views present a much greater level of concern than views from private homes or developed lakes and ponds.

Solar Energy

I have reviewed quite a few solar projects within Vermont and observed many others. Solar panels are quite large objects and are appearing across the landscape in various forms (solar farms and individual panels or groups of panels). A typical 2.2MW solar farm occupies about 15 acres of land. Most have been well sited, but given the potential for a significant number of these panels and projects around the state, along with their size and industrial character, siting guidelines at all project scales would be helpful. In a recent decision, the PSB expressed concern about a 2.2MW solar farm located in a scenic agricultural residential setting, but noted that there were no guidelines for their appropriate or inappropriate siting.[4]

Solar Siting and Design Considerations (Examples)

[4] Order available at: http://psb.vermont.gov/sites/psb/files/orders/2012/2012-4/7844%20OrderReInterventions.pdf

Solar Farms

- Strongly encourage solar farms on land that is within or near already developed areas especially within commercial or industrial zoning districts.
- Avoid areas of high agricultural, natural, or forest resource values (unless in commercial or industrial zones)
- Encourage Towns to identify where they would like to see projects; encourage towns to build them and/or benefit financially from them.
- If they are located in residential or rural areas they should be screened from view as much as possible. Screening is especially important if the back (north) side is visible from a public vantage point as this side tends to be light in color (often white which is highly visible) and visually cluttered.
- Consider the design and location of associated infrastructure. Inverter structures for example should be simple in design, unobtrusively located and dark in color, preferable a similar black to the solar panels themselves to keep the project simple in form and design.
- Keep the layout as compact as possible.

Individual Solar Panels or Groups of Panels

My biggest concern about the siting of individual and groups of panels is that they often appear randomly located and ignore many of the basic principles we expect in siting other forms of development. Here are a few basic recommendations:

- Keep them as close to existing development as possible (e.g barns, outbuildings, villages) vs. scattering them in valuable open space.
- Reflect the traditional landscape patterns in siting them: e.g. along existing hedgerows (at the edge rather than in the center of a field), orient them as close as possible parallel or perpendicular to nearby buildings. This is a classic pattern in the Vermont landscape. While solar panels need to be oriented south, most of our historic structures have a similar orientation that can be repeated as closely as possible.
- Keep them compactly organized. Attached panels, or closely staggered groups of three panels to break up long rows.
- If the back side (which is often white and more visual cluttered in appearance) is visible from the road or to neighbors, add some plantings to screen it or located it where natural plantings screen the back side of the panels.
- Pay particular attention to the design and location of the inverter equipment. These are often on very slapdash wooden boards that are highly unattractive and noticeable due to the light colors and thoughtless construction. Place these where they can be screened or softened with existing vegetation, and as low as possible. Developers and installers need to come up with better standard designs for these associated facilities, which can be more unattractive and noticeable than the panels themselves.